

PB92-108778

Screening Methods for the Development of Air Toxics Emission Factors

Radian Corp., Research Triangle Park, NC

Prepared for:

Environmental Protection Agency, Research Triangle Park, NC

Sep 91



U.S. Department of Commerce
National Technical Information Service

NTIS

PB92-10E778

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

TECHNICAL REPORT DATA		
(Please read Instructions on the reverse before completion)		
1. REPORT NO. EPA-450/4-91-021	2.	3. R PB92-108778
4. TITLE AND SUBTITLE Screening Methods For The Development of Air Toxics Emission Factors	5. REPORT DATE September 1991	
	6. PERFORMING ORGANIZATION CODE	
7. AUTHOR(S) Joan T. Bursey	8. PERFORMING ORGANIZATION REPORT NO.	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Radian Corporation P.O. Box 13000 Research Triangle Park, NC 27709	10. PROGRAM ELEMENT NO.	
	11. CONTRACT/GRANT NO. 68D90054	
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, NC 27711	13. TYPE OF REPORT AND PERIOD COVERED Final	
	14. SPONSORING AGENCY CODE	
15. SUPPLEMENTARY NOTES		
16. ABSTRACT Under this program, the literature has been surveyed to determine the applicability of existing methodology. The primary goal was to use methodology applicable to the largest number of analytes listed in the Clean Air Act Amendments, with the full realization that a broad coverage by a methodology may require some sacrifice of sensitivity and accuracy. The need for validation of proposed methodologies has been recognized. Assignments of analytes to a specific methodology have been made on the basis of previous validation studies and/or physical properties (available physical properties for the chemicals of the Clean Air Act list are supplied in an appendix). The range of applicability of a given sampling or analytical method, when available, is included as a part of the method description. Tables are included which summarize the potentially applicable sampling and analytical methods for chemicals listed in the Clean Air Act Amendments. General information on cost for the sampling and analysis procedures is presented.		
17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Toxic Air Pollutants Measurements Sampling Techniques Analytical Techniques Screening Methods		
18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 456
	20. SECURITY CLASS (This page) Unclassified	22. PRICE

SCREENING METHODS FOR THE DEVELOPMENT OF AIR TOXICS EMISSION FACTORS

By

Joan T. Bursey
Radian Corporation
Research Triangle Park, NC 27709

EPA Contract No. 68D90054

EPA Project Officer: William B. Kuykendal

Office Of Air Quality Planning And Standards
Office Of Air And Radiation
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

September 1991

j. a.

This report has been reviewed by the Office Of Air Quality Planning And Standards, U. S. Environmental Protection Agency, and has been approved for publication. Any mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use.

EPA-450/4-91-021

TABLE OF CONTENTS

	Page
List of Tables	vi
List of Figures	vi
1.0 INTRODUCTION	1-1
1.1 References	1-6
2.0 SUMMARY OF SAMPLING/ANALYTICAL METHODS FOR CLEAN AIR ACT LIST CHEMICALS	2-1
2.1 Alternative Methods	2-28
2.2 Stationary Source non-Point Emissions	2-36
2.3 Making Use of Collected Information	2-36
2.4 Validation of Proposed Methodology	2-55
2.5 Quality Assurance/Quality Control (QA/QC) Procedures	2-60
3.0 DESCRIPTIONS OF METHODS	3-1
EPA Method 0010	3-3
EPA Draft Method 0011	3-11
EPA Method 0012	3-13
EPA Method 0030	3-17
EPA Draft Method 0050	3-23
EPA Method 0051	3-25
EPA Method 5040	3-27
EPA Draft Method 5041	3-31
EPA Method 8080	3-39
EPA Method 8270	3-43
EPA Method 8280	3-55
EPA Draft Method 8290	3-59
EPA Method 8310	3-63
EPA Draft Method 8315	3-67
EPA Draft Method 8318	3-71
EPA Method 9057	3-75
Method TO-1	3-77
Method TO-2	3-81

TABLE OF CONTENTS (Continued)

	Page
Method TO-4	3-85
Method TO-5	3-87
Method TO-6	3-89
Method TO-7	3-91
Method TO-8	3-93
Method TO-9	3-95
Method TO-10	3-97
Method TO-11	3-99
Method TO-13	3-101
Method TO-14	3-107
 CARB Method 427	 3-111
CARB Method 429	3-113
CARB Method 431	3-117
 NIOSH Method 2515	 3-119
NIOSH Method 7400	3-121
NIOSH Methods 9010 and 9012	3-123
 OSHA Method ID-101	 3-125
 EPA Method 6	 3-127
EPA Methods 7C and 7D	3-129
EPA Method 12	3-131
EPA Method 13A	3-133
EPA Method 13B	3-135
EPA Method 14	3-137
EPA Method 15	3-139
EPA Method 18	3-141
EPA Method 23	3-145
EPA Method 101	3-149
EPA Method 101A	3-151
EPA Method 103	3-153
EPA Method 104	3-155
EPA Method 106	3-157
EPA Method 114	3-159
EPA Methods 515/615	3-165
EPA Method 531	3-169
EPA Method 632	3-173
EPA Method 680	3-177

TABLE OF CONTENTS (Continued)

	Page
4.0	
SAMPLING AND ANALYSIS PROCEDURES COSTS	4-1

APPENDICES

- A Physical Properties of Proposed Clean Air Act Compounds/Chemicals
- B NIOSH and OSHA Ambient Air Methods
- C Clean Air Act List Chemicals, Database Compiled by Southern Research Institute

LIST OF TABLES

		Page
1	Primary Sampling and Analytical Methods for Clean Air Act Chemicals	2-2
2	Alternative Sampling and Analytical Methodology	2-29
3	Sampling and Analytical Methodology for Stationary Source non-Point Emissions	2-37
4	Estimated Sampling and Analytical Costs	4-2

LIST OF FIGURES

		Page
1	Volatile Organic Compounds	2-56
2	Semivolatile Organic Compounds	2-57

SECTION 1.0

INTRODUCTION

The Clean Air Act Amendments of 1990 renew and intensify national efforts to reduce air pollution at a level that surpasses all previous efforts in environmental regulation. The Amendments, as set forth, list 189 hazardous air pollutants, also called air toxics, and require the Environmental Protection Agency to promulgate new control standards for the principal sources of such emissions. These 189 hazardous air pollutants are chemicals that were not previously regulated under the National Ambient Air Quality Standards, that applied to a small number of the most common pollutants. The requirements of the Clean Air Act dictate immediate sampling and analysis to obtain data for the determination of emission factors. These emission factors will be used to determine control measures. However, since many of the analytes listed in the Clean Air Act Amendments of 1990 have not previously been regulated, the fundamental questions of how to sample and analyze to produce data of a quality sufficient to achieve the objective of emission factor determination must be addressed.

Before any testing of stationary sources is conducted, it is desirable that a written sampling and analytical protocol be available to ensure that data acquired during source testing are accurate and of known quality. Alternatively, validation of a proposed sampling and analytical methodology can be performed according to EPA Method 301.¹ Because of the concern over the presence of low concentrations of these 189 hazardous air pollutants in air, existing sampling and analytical methods were reviewed in order to determine the applicability of these methods to the 189 hazardous air pollutants. For some of these hazardous air pollutants, the existing sampling and analytical methodologies are directly pertinent to the analyte of interest in emissions from stationary sources, and the performance parameters for the compounds have been completely defined. For some portion of the 189 hazardous air pollutants, data were

available to substantiate, at least in part, performance of an analytical methodology, but no information was available in the literature to establish whether the compound could be sampled quantitatively. For a significant percentage of the list of 189 hazardous air pollutants, assignment to a sampling and analytical methodology could be made tentatively only on the basis of chemical or physical correspondence to other compounds which have been sampled and analyzed with the methodology. For most of the 189 hazardous air pollutants, sampling and analytical methodology available at the present time can serve only as screening methods to establish presence or absence under a given set of conditions.

There is a great deal of concern in assigning analytes to any given sampling and/or analytical methodology, since definitive information that the specified methodology is actually effective for the analyte in question does not exist. The following concerns must be satisfied when a methodology is applied:

- Does the sampling methodology sample the analyte effectively and quantitatively?

Some of the areas which cause concern are: If temperatures in a sampling train are not high enough, some analytes may not reach the sampling medium. A given analyte may not be retained quantitatively by the sampling medium of the train. An aqueous impinger as a component of a sampling train may cause decomposition of some analytes. There are many other problems which can occur in conjunction with sampling which may render a sampling methodology incapable of quantitative sampling for a given analyte.

- Does the laboratory sample preparation methodology transfer the analyte quantitatively from the sampling train to the analytical instrument?

Some of the areas which cause concern are: Analytes may not be extracted quantitatively from the sampling media under the

standard analytical conditions of a given method, analytes may decompose in the handling of the samples, analytes may react with other analytes or with reagents used in the sample preparation process, or analytes may be lost in a concentration step. There are many other problems which can occur in the process of sample preparation which can result in the inability to generate quantitative and reproducible data.

- Can the analytical method produce precise, accurate, and quantitative results for all of the analytes in question?

Some of the areas which cause concern are: Analytes may decompose in the analytical process or may react in the course of analysis, analytes may not be amenable to a given method of analysis because of polarity, volatility, or other properties, analytes may require modification such as derivatization for optimum analysis, or other chemical or physical properties of the analytes may cause poor or unsuccessful performance of the analytical methodology.

To sample and analyze constituents of emissions from stationary sources adequately, it is necessary to define the quality objectives which are required for the measurement. If the data quality objectives require the use of a validated methodology, the proposed method must be qualified. The only way to be assured of successful data from a given sampling and analytical methodology is to have a method which is validated for the analyte of interest. The sampling and analytical parameters which require definition in order to have a validated methodology are the bias (systematic error) and precision (random error). When these parameters have been defined for a given hazardous air pollutant in a particular sampling and analytical methodology, the methodology is validated: that is, the performance of the entire sampling and analytical methodology under field conditions has been evaluated. To validate a method for a given analyte, the following procedures must be performed:¹

- A known concentration of an analyte must be introduced in the sampling procedure and carried through the entire sampling and analytical procedure to assess the bias of the proposed method;
- Alternatively, the proposed test method may be compared against a previously validated test method in order to assess bias; and
- Multiple or collocated simultaneous samples must be collected to determine the precision of the test method.

Sampling procedures have been established which will allow the determination of the bias and precision of data from field testing. These approaches include:¹

- Isotopic spiking, for analytical methods that require gas chromatography/mass spectrometry (GC/MS) for analysis;
- Comparison against a validated test method; and
- Spiking of the analyte.

In these approaches, procedures have been specified to perform the spiking and obtain a sufficient number of spiked samples to allow statistical determination of the validity of the proposed test method.¹ When these precision and bias parameters have been established, a methodology is considered validated for a particular compound and a particular type of source.

The ultimate goal of both the regulatory and the regulated communities is to have validated test methods available for any analyte which may require testing. However, the need for information is immediate since the Clean Air Act Amendments have been passed, and completely validated test methodologies are presently available for only a small number of analytes. The regulatory requirements will not allow the gathering of

information to be deferred until validated test methodologies are available for each of the 189 hazardous air pollutants, nor are resources available for the Environmental Protection Agency to provide validated methodology for every possible analyte. It will therefore be necessary to use methodology which presently exists to gather screening information for the broadest possible number of analytes, until broad-based methods are validated for large numbers of analytes. The purpose of the catalog of methods presented here is to identify methods with the broadest possible applicability to the 189 hazardous air pollutants listed in the Clean Air Act Amendments of 1990. Many single-analyte methods are already validated for specific source categories, but the focus of this document is screening methods with broad coverage.

Under this program, the literature has been surveyed to determine the applicability of existing methodology. The primary goal was to use methodology applicable to the largest number of analytes listed in the Clean Air Act Amendments, with the full realization that a broad coverage by a methodology may require some sacrifice of sensitivity and accuracy. Specialized sampling and analytical methodologies may be available to apply to a single analyte, for example, or to one particular family of analytes. If a survey method is used instead of a specialized methodology, detection limits will be higher and there is a risk that trace quantities of the analyte in question will not be observed. On the other hand, if the survey methodology indicates the presence of significant quantities of an analyte for which a specialized methodology is available, an informed decision can be made on whether to use the specialized methodology in subsequent testing. The need for validation of proposed methodologies has been recognized. Assignments of analytes to a specific methodology have been made on the basis of previous validation studies and/or physical properties (available physical properties for the chemicals of the Clean Air Act list are supplied in Appendix A). The range of applicability of a given sampling or analytical method, when available, is included as a part of the method description in Section 3.0. Section 2.0 includes several

tables which summarize the potentially applicable sampling and analytical methods for chemicals listed in the Clean Air Act Amendments. Section 4.0 provides some general information on cost for the sampling and analysis procedures. The appendices provide a listing of available physical properties (Appendix A), a summary of NIOSH and OSHA methods and applicable analytes (Appendix B), and a listing for the Clean Air Act list analytes from the Problem POHC Directory, prepared by Southern Research Institute² (Appendix C).

When a sampling/analytical methodology is selected for a given analyte or group of analytes, the first priority should be given to the use of existing Federal Register methods (40 CFR Parts 60 and 61) which have been validated specifically for the analytes of interest in stationary sources. A secondary priority in selection of methods should be given to existing Federal Register methods for other programs such as OSW RCRA trial burns. A tertiary priority is assigned to methods from state agencies or other Federal agencies such as NIOSH or OSHA. The lowest level of priority in selection of sampling/analytical methods should be given to methods which are research candidates, draft methods, or test methods, which have possible applicability to the analytes and matrix but have no validation data available.

Many of the sampling and analytical procedures need additional development and validation efforts to improve accuracy and precision. It should be stressed that a method which requires validation is not an inferior method; the method simply requires additional experimentation to define precision and bias. The performance of the method for a given analyte and source may be entirely acceptable, but until validation data are available, the user cannot know that the performance of the method will be acceptable prior to use.

Methods cited in this document are presently in use, regardless of validation status. Remote sensing techniques, such as Fourier Transform Infra-Red and Fourier Transform Ultra-Violet, have potential as emission inventory and air toxics factor measurement methods. Air toxics emission rate analysis using remote sensing measurement methods has not been validated at this time, and extensive field testing is required to establish accuracy and precision for these methodologies. Newer surface analytical techniques to measure semivolatile and condensable toxic air pollutants that may be associated with particulate materials (especially PM-10) are also being investigated. Present techniques for sampling and analysis require laborious, time-consuming, and costly extraction procedures to concentrate and analyze toxic organics on particles. Some of the newer instrumental techniques such as laser-induced mass analysis or time-of-flight techniques may prove feasible for future air toxic analysis.

1.1 References

1. Method 301, Protocol for the Field Validation of Emission Concentrations from Stationary Sources, EPA 450/4-90-015. Effective February 1991.
2. Problem POHC Reference Directory, EPA 600/3-90/094, Effective January 1991. Prepared by Southern Research Institute.

SECTION 2

SUMMARY OF SAMPLING/ANALYTICAL METHODS FOR CLEAN AIR ACT LIST CHEMICALS

The primary sampling and analytical methods for the analytes listed in the Clean Air Act Amendments are shown in Table 1. The selection of a primary method for a given analyte was governed by the following considerations:

- Applicability of a given sampling and analytical methodology to a wide range of analytes;
- Availability of a sampling/analytical methodology which directly addresses stationary sources; and
- Availability of a validated methodology for a particular analyte.

Chemicals are listed alphabetically in Table 1, with primary sampling and analytical methods. If two validated methodologies are available for a given analyte, both are listed as primary methods. Many validated single-analyte methods are omitted to focus on broad coverage. A "Comments" section is provided to address validation status of methodology and to provide information on known problems which will be encountered with a given analyte. These comments describe problems such as "Decomposes upon heating", "Explosive", etc. More detailed information on a compound by compound basis is provided in Appendix C, where sampling and analytical problems are described for each analyte. An additional entry in Table 1 is "Target Compound for Method 8270". Method 8270 is an analytical methodology which incorporates the use of gas chromatography/mass spectrometry (GC/MS) as an analytical technique for semivolatile compounds. A semivolatile compound is any organic compound which boils above 100°C. The method includes a specific list of analytes for which the application of the analytical methodology has been validated, and these analytes are referred to as "Target

Table 1

Primary Sampling and Analytical Methods for Clean Air Act Chemicals

Chemical/Compound	Sampling	Analysis	Comments
Acetaldehyde	Draft 0011	Draft 8315	Requires validation.
Acetamide	0010	8270	Requires validation.
Acetonitrile	18	18	Specific GC detector required.
Acetophenone	0010	8270	Method 8270 target.
2-Acetylaminofluorene	0010	8270	Requires validation.
Acrolein	Draft 0011	Draft 8315	Requires validation.
Acrylamide	0010	8270	Requires validation.
Acrylic acid	0010	8270	Requires validation. Methodology optimized with control of pH during extraction and derivatization.
Acrylonitrile	0030	5040, Draft 5041 ^a	Analysis of condensate suggested. Analytical methodology validated for modified 5040.
Allyl chloride	0030	5040, Draft 5041	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
4-Aminobiphenyl	0010	8270	Requires validation. Samples unstable at ambient temperatures. Requires control of pH during extraction.
Aniline	0010	8270	Method 8270 target.
o-Anisidine	0010	8270	Requires validation.
Benzene	0030	5040, Draft 5041	Validated methodology.
Benzidine	0010	8270	Target compound for Method 8270. Compound decomposes readily and chromatographs poorly.
Benzyl chloride	0010	8270	Requires validation.
Biphenyl	0010	8270	Target compound for Method 8270.
Bis (2-ethylhexyl) phthalate	0010	8270	Target compound for Method 8270.
Bis (chloromethyl) ether	18	18	Compound is very reactive and decomposes in water. Method development required.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Bromoform	0010	8270	Volatile compound; easily lost in concentration of extract.
1,3-Butadiene	18	18	Methodology has been validated.
Caprolactam	0010	8270/632	Requires validation. Amenability to gas chromatographic techniques (8270) not established; may require use of high performance liquid chromatography (632).
Captan	0010	8270	Requires validation.
Carbaryl	0010	8318	Requires validation.
Carbon disulfide	0030	5040, Draft 5041	Requires validation. Compound decomposes on standing.
Carbon tetrachloride	0030	5040, Draft 5041	Methodology validated.
Carbonyl sulfide	15	15	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Catechol	0010	8270	Requires validation. Control of pH during extraction is required for optimal recovery.
Chloramben	0010	515/615	Requires validation.
Chlordane	0010	8270	Target compound for Method 8270.
Chloroacetic acid	0010	8270	Control of pH during extraction is required for optimal recovery. Must be derivatized for successful gas chromatographic analysis.
2-Chloroacetophenone	0010	8270	Requires validation.
Chlorobenzene	0010 0030	8270 5040, Draft 5041	Compound is on the border of volatility for applicability of either of the two methods. Special precautions must be taken with either method. Validated for both methods.
Chlorobenzilate	0010	8270	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Chloroform	0030	5040, Draft 5041	Methodology validated.
Chloromethyl methyl ether	0030	5040, Draft 5041 ^a	Compound is water- soluble; method 5040 methodology must be modified for optimum recovery.
Chloroprene	0030	5040, Draft 5041	Requires validation.
o-Cresol	0010	8270	Method 8270 target compound.
m-Cresol	0010	8270	Method 8270 target compound.
p-Cresol	0010	8270	Method 8270 target compound.
Cresylic acid	0010	8270	Cresylic acid is a mixture of cresols, which are all target compounds for Method 8270.
Cumene	0010	8270	Requires validation; sufficiently volatile to be lost in extract concentration.
2,4-D salts and esters	0010	515/615	Requires validation.
DDE	0010	8270	Method 8270 target.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Diazomethane			Extremely explosive; reactive; existence in stacks and ambient air atmospheres questionable. Method development required.
Dibenzofurans	Method 23	Method 23	
1,2-Dibromo-3-chloropropane	0010	8270	Requires validation.
Dibutyl phthalate	0010	8270	Method 8270
1,4-Dichlorobenzene	0010	8270	Method 8270 target; may be lost in extract concentration.
3,3'-Dichlorobenzidene	0010	8270	Careful control of pH during extraction required for optimum recovery; chromatographs poorly. Validation required.
Dichloroethyl ether	0010	8270	Requires validation.
1,3-Dichloropropene	0030	5040/Draft 5041	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Dichlorvos	0010	8270	Requires validation.
Diethanolamine	0010	8270	Requires validation; chromatography may be very poor.
N,N-Diethylaniline	0010	8270	Requires validation; requires control of pH during extraction for optimum recovery.
Diethyl sulfate	0010	8270	Requires validation.
3,3'-Dimethoxybenzidine	0010	8270	Requires validation; requires careful control of pH during extraction for optimum recovery. Chromatographs poorly.
Dimethylaminoazobenzene	0010	8270	Method 8270 target.
3,3'-Dimethylbenzidine	0010	8270	Requires validation; requires careful control of pH during extraction for optimum recovery. Chromatographs poorly.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Dimethyl carbamoyl chloride	0010	531	Requires validation; compound decomposes in water and is very reactive.
Dimethyl formamide	0010	8270	Requires validation.
1,1-Dimethylhydrazine	0030	5040/Draft 5041 ^a	Compound unstable and water-soluble. Analysis of condensate suggested.
Dimethyl phthalate	0010	8270	Method 8270 target; common laboratory contaminant.
Dimethyl sulfate	0010	8270	Requires validation. Compound decomposes at 188°C.
4,6-Dinitro-o-cresol and salts	0010	8270, 515/615	Requires validation. Method 8270 applies to 4,6-Dinitro-o-cresol only. Compounds are very reactive.
2,4-Dinitrophenol	0010	8270	Method 8270 target.
2,4-Dinitrotoluene	0010	8270	Method 8270 target.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
1,4-Dioxane	0010	8270	Method has been validated. Compound is sufficiently volatile to be lost in extract concentration.
1,2-Diphenylhydrazine	0010	8270	Method 8270 target.
Epichlorohydrin	0010	8270	Requires validation.
1,2-Epoxybutane	0030	5040/Draft 5041 ^a	Requires validation. Reactive compound. Analysis of condensate suggested.
Ethyl Acrylate	0030	5040/Draft 5041 ^a	Requires validation. Analysis of condensate suggested.
Ethylbenzene	0010	8270	Requires validation. Compound is sufficiently volatile to be lost in extract concentration.
Ethyl carbamate	0010	8270	Requires validation. Compound is very reactive and polymerizes readily.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Ethyl chloride	0030	5040/Draft 5041	Very volatile compound; special precautions required to avoid sorbent breakthrough.
Ethylene dibromide	0010	8270	Requires validation. Compound is sufficiently volatile to be lost in extract concentration.
Ethylene dichloride	0030	5040/Draft 5041	Requires validation.
Ethylene glycol	0010	8270	Requires validation.
Ethylene imine	0030	5040/Draft 5041 ^a	Requires validation. Hydrocarbons will interfere with analysis. Compound is reactive and polymerizes easily. Compound will probably be present in the condensate in the sampling train.
Ethylene oxide	18 CARB 431	18 CARB 431	Compound is explosive and water-soluble.
Ethylene thiourea	0010	632	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Ethylidene dichloride	0030	5040/Draft 5041	Requires validation.
Formaldehyde	Draft 0011	Draft 8315	Requires validation.
Glycol ethers	0010	8270	Category too broad for a single method. Non-volatile or polar glycol ethers will require HPLC analysis.
Heptachlor	0010	8270	Method 8270 target.
Hexachlorobenzene	0010	8270	Method 8270 target.
Hexachlorobutadiene	0010	8270	Method 8270 target.
Hexachlorocyclopentadiene	0010	8270	Method 8270 target.
Hexachloroethane	0010	8270	Method 8270 target. Laboratory validation of the methodology.
Hexamethylene-1,6-diisocyanate	0010	8270	Compound is very reactive; reacts with water. Present in gas and particulate phases.
Hexamethylphosphoramide	0010	632	Requires validation; very reactive compound.
Hexane	0030	5040/Draft 5041	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Hydrazine	18	18	Compound is unstable, reactive, and water-soluble. Method development required.
Hydroquinone	0010	8270	Requires validation. Compound is very reactive and oxidizes readily.
Isophorone	0010	8270	Method 8270 target.
Lindane	0010	8270	Method 8270 target.
Maleic anhydride	0010	8270	Requires validation.
Methanol	18	18	Mass spectrometric analysis difficult because mass of methanol (32) is the same as the mass of oxygen. GC analysis preferred.
Methoxychlor	0010	8270	Method 8270 target.
Methyl bromide	0030	5040/Draft 5041	Special precautions are required to avoid sorbent breakthrough.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Methyl chloride	0030	5040/Draft 5041	Special precautions are required to avoid sorbent breakthrough.
Methyl chloroform	0030	5040/Draft 5041	Validated methodology.
Methyl ethyl ketone	Draft 0011	Draft 8315	Requires validation.
Methyl hydrazine	0030	5040/Draft 5041 ^a	Requires validation; analysis of condensate required.
Methyl iodide	0030	5040/Draft 5041	Requires validation; decomposes at elevated temperatures.
Methyl isobutyl ketone	Draft 0011	Draft 8315	Requires validation.
Methyl isocyanate	0030	5040/Draft 5041 ^a	Compound is polar, water-soluble, and reactive. May require development of a new method. Analysis of condensate suggested.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Methyl methacrylate	0030	5040/Draft 5041 ^a	Requires validation. Compound may polymerize upon heating. Analysis of condensate suggested.
Methyl tert-butyl ether	0010	8270	Requires validation.
4,4'-Methylene bis (2- chloroaniline)	0010	8270	Requires validation.
Methylene chloride	0030	5040/Draft 5041	Methodology requires validation; common laboratory contaminant.
Methylene diphenyl diisocyanate	0010	8270	Requires validation.
4,4'-Methylenedianiline	0010	8270	Requires validation; compound is very reactive.
Naphthalene	0010	8270	Method 8270 target.
Nitrobenzene	0010	8270	Method 8270 target; methodology validated.
4-Nitrobiphenyl	0010	8270	Requires validation; may decompose on heating.
4-Nitrophenol	0010	8270	Method 8270 target.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
2-Nitropropane	0010	8270	Requires validation; compound is reactive and explosive, and may decompose upon heating.
N-Nitroso-N-methylurea	0010	8270	Requires validation. Compound is very reactive, and is near the limits of volatility for gas chromatography.
N-Nitrosodimethylamine	0010	8270	Method 8270 target; very reactive compound.
N-Nitrosomorpholine	0010	8270	Requires validation; compound is very reactive.
Parathion	0010	8270	Requires validation.
Pentachloronitrobenzene	0010	8270	Method 8270 target.
Pentachlorophenol	0010	8270	Method 8270 target.
Phenol	0010	8270	Method 8270 target; methodology validated.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
p-Phenylenediamine	0010	8270	Requires validation. Requires control of pH during extraction for optimum recovery.
Phosgene			No stationary source sampling/analytical methodology presently available.
Phthalic anhydride	0010	8270	Requires validation. Compound reacts with water.
Polychlorinated biphenyls	0010	680	Method 8080 not applicable to stack samples since Aroclor pattern will be disrupted.
1,3-Propane sultone	0010	8270	Requires validation.
beta-Propiolactone	0010	8270	Requires validation. Compound may decompose upon heating.
Propionaldehyde	Draft 0011	Draft 8315	Requires validation.
Propoxur	0010	8318	Requires validation. Compound is reactive and may decompose upon heating.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Propylene dichloride	0030	5040/Draft 5041	Requires validation.
Propylene oxide	0030	5040/Draft 5041 ^a	Requires validation. Compound is reactive and water- soluble. Analysis of condensate suggested.
1,2-Propylenimine	0030	5040/Draft 5041 ^a	Requires validation. Compound is reactive and may decompose when heated. Analysis of condensate suggested.
Quinoline	0010	8270	Requires validation. Control of pH during extraction required for optimum recovery.
Quinone	Draft 0011	Draft 8315	Requires validation.
Styrene	0010	8270	Requires validation. Compound is sufficiently volatile to be lost in extract concentration.
Styrene oxide	0010	8270	Requires validation. Compound is reactive.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
2,3,7,8-Tetrachlorodibenzo-p-dioxin	23	23	The spiking scheme for Method 23 may cause concern in some regulatory areas.
1,1,2,2-Tetrachloroethane	0010	8270	Validated methodology.
Tetrachloroethylene	0030	5040/Draft 5041	Validated methodology.
Toluene	0030	5040/Draft 5041	Validated methodology.
	0010	8270	Validated methodology. Compound is sufficiently volatile to encounter losses in extract concentration.
2,4-Toluene diamine	0010	8270	Requires validation. Control of pH essential for optimum extraction recovery.
2,4-Toluene diisocyanate	0010	8270	Requires validation. Compound is very reactive.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
o-Toluidine	0010	8270	Requires validation. Control of pH essential for optimum recovery during extraction.
Toxaphene	0010	8270	Method 8270 target. Toxaphene is a multicomponent group of chlorinated camphenes which may decompose upon heating.
1,2,4-Trichlorobenzene	0010	8270	Method 8270 target.
1,1,2-Trichloroethane	0030	5040/Draft 5041	Methodology validated.
Trichloroethylene	0030	5040/Draft 5041	Methodology validated.
2,4,5-Trichlorophenol	0010	8270	Methodology 8270 target.
2,4,6-Trichlorophenol	0010	8270	Method 8270 target.
Triethylamine	0030	5040/Draft 5041 ^a	Requires validation. Compound is reactive and water-soluble.
Trifluralin	0010	8270	Requires validation. Compound is very reactive.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
2,2,4-Trimethylpentane	0030	5040/Draft 5041	Requires validation.
Vinyl acetate	0030	5040/Draft 5041 ^a	Requires validation. Compound is reactive, water-soluble, and polymerizes upon exposure to light. Analysis of condensate suggested.
Vinyl bromide	0030	5040/Draft 5041	Requires validation. Special precautions required in sampling to avoid sorbent breakthrough.
Vinyl chloride	0030	5040/Draft 5041	Methodology validated. Special precautions required in sampling to avoid sorbent breakthrough.
Vinylidene chloride	0030	5040/Draft 5041	Special precautions required in sampling to avoid sorbent breakthrough. Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Xylenes (isomers and mixture)	0010	8270	Requires validation. Special care must be taken in extract concentration to avoid compound loss.
o-Xylene	0010	8270	Requires validation. Special care must be taken in extract concentration to avoid compound loss.
m-Xylene	0010	8270	Requires validation. Special care must be taken in extract concentration to avoid compound loss.
p-Xylene	0010	8270	Requires validation. Special care must be taken in extract concentration to avoid compound loss.
Antimony compounds	Draft 0012	Draft 0012	Requires validation.
Arsenic compounds	Draft 0012	Draft 0012	Requires validation.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Asbestos	CARB 427	CARB 427	Methodology will not differentiate between asbestos and other mineral fibers. A fiber emission may have a wide range in particle size. Side-by-side measurements by visual observation, PCM, and TEM are required to characterize particle size in order to choose an appropriate analytical method.
Beryllium compounds	Draft 0012	Draft 0012	Requires validation.
Cadmium compounds	Draft 0012	Draft 0012	Requires validation.
Calcium cyanamide			Decomposes in cold water; reacts with acid; may polymerize in water/alkali. Method development required.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Chlorine	0050, 0051	9057	Choice between 0050 and 0051 determined by presence of water droplets.
Chromium compounds	Draft 0012	Draft 0012	Requires validation.
Cobalt compounds	Draft 0012	Draft 0012	Requires validation.
Coke oven emissions	0010	8310	Coke oven emissions constitute a complex family of compounds, not totally addressed by one methodology. Methodology listed addresses polynuclear aromatic hydrocarbons, a major constituent of coke oven emissions and may be modified to address functionalized compounds.
Cyanide compounds	6 (modified)	NIOSH 7904	Method 6 impinger solution modified to 0.1N KOH; analysis is performed for HCN and cyanide salts.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Hydrochloric acid	0050, 0051	9057	Choice between 0050 and 0051 determined by presence of water droplets.
Hydrogen fluoride	13 A or B	13 A or B	
Lead compounds	Draft 0012 ^b	Draft 0012	Requires validation.
Manganese compounds	Draft 0012	Draft 0012	Requires validation.
Mercury compounds	Draft 0012	Draft 0012	Requires validation.
Mineral fibers	CARB 427 ^c	CARB 427 ^c	Methodology will not differentiate between mineral fibers and asbestos.
Nickel compounds	Draft 0012	Draft 0012	Requires validation.
Phosphine	Draft 0012	Draft 00112	Requires validation; methodology cannot differentiate among forms of phosphorus.
Phosphorus	Draft 0012	Draft 0012	Requires validation. Phosphorus is reactive and explosive, and undergoes spontaneous combustion upon contact with air.

Table 1

Continued

Chemical/Compound	Sampling	Analysis	Comments
Polycyclic organic matter	CARB 429	CARB 429	Complex group of compounds; not all adequately addressed by the methodology.
Radionuclides	114	114	Methodology will detect gaseous and particulate forms.
Selenium compounds	Draft 0012	Draft 0012	Requires validation.
Titanium tetrachloride	Draft 0012	Draft 0012	Requires validation. Methodology cannot differentiate forms of titanium. Compound decomposes at ambient moisture levels.

- ^a Method 5040 or Draft 5041 modified to optimize recovery of water-soluble compounds (EPA 600/8-877-008).
- ^b Draft Method 0012 does not speciate inorganic compounds.
- ^c See Comments for Asbestos.

compound for Method 8270." For these target compounds, the precision and bias of an overall sampling and analytical methodology have not been established: the combined sampling and analytical methodology is not validated. However, the analytical methodology has at least been tested and operating parameters for the analysis have been established.

Table 1 is not comprehensive. Every available methodology which might possibly be applicable is not listed. A major consideration for the selection of methodology was the broadest possible coverage: a single-analyte method has been used as a primary method only in those situations where no multiple analyte method could be considered applicable.

Several methods in Table 1 are labeled "Draft." A Draft Method is in a review process prior to inclusion in a compendium of methods or promulgation in the Federal Register. For Draft EPA Methods, the text of the Method may be obtained through the Emission Measurements Technical Information Center (EMTIC), which can be reached by telephone at (919) 541-1059. The availability of a text of the Draft Methods is determined by the EPA laboratory responsible for the development of the Method. Some of the EPA laboratories are willing to release the text of a Draft Method as soon as the Method is written, while other EPA laboratories will release no Method until all of the review process is complete. If a Draft Method is available, the text can be obtained from EMTIC.

Some of the Methods listed in Table 1 are specifically written to address gaseous emissions from stationary sources. Other methods are written to address liquid or solid hazardous waste, soil, leachates, or water of various types. When a sorbent is used in the sampling methodology, the solution obtained from the extraction of the sorbent can be treated similarly to the extract of water or the extract of a hazardous waste or other

media. Some adaptation of the sample preparation methodology will be required to address air as a sampling matrix and, in general, the adaptations or modifications required to make the analytical methodology directly applicable to gaseous emissions as a sampling matrix have not been appended to the methodology. Some of the analytes listed in Table 1 explode at elevated temperatures or react with ambient levels of moisture. However, occurrence of such an analyte at levels of parts per million in a stationary source may mean that a significant portion of that analyte may survive intact to be sampled and analyzed. Appropriate laboratory and field experiments are required to establish the loss or survival of certain analytes under the conditions encountered at a stationary source.

When a Table 1 method is described as "Validated," precision and bias for the sampling and analysis of that analyte have been established for a single stationary source.

2.1 Alternative Methods

Table 2 provides a listing of alternative sampling and analytical methods. These methods are a secondary choice to the methods shown in Table 1 as the primary methods. In many cases, the methodology cited as Alternative Methodology is a more specific or more focused methodology than the methodology listed in Table 1, even though the method may be validated. Broad applicability for screening was the main criterion in the selection of primary methodology. For example, Method 18 is cited frequently as an alternative method for volatile organic compounds. Method 18 is used for single analytes or, perhaps, for a small number of analytes. Method 0030 combined with Method 5040 or Draft Method 5041 would have a broader application to a wide range of analytes (all volatile organic compounds with a boiling point less than 100°C), and would therefore be the choice as the primary method. In some instances, it is

Table 2
Alternative Sampling and Analytical Methodology

Compound/Chemical	Sampling	Analysis	Comments
Acetaldehyde	0030	5040, Draft 5041 ^a	Requires modification of analytical conditions. Analysis of condensate suggested.
Acetophenone	Draft 0011	Draft 8315	Requires validation.
Acrolein	18	18	
Allyl chloride	18	18	
Biphenyl	0010	8310	
Bromoform	0030	5040, Draft 5041	Non-quantitative; boiling point outside directly applicable range of methodology.
Carbon disulfide	15	15	Compound may decompose upon standing.
Carbonyl sulfide	0030	5040, Draft 5041	Non-quantitative methodology; boiling point outside directly applicable range of methodology. Analysis of condensate suggested.
2-Chloroacetophenone	Draft 0011	Draft 8315	Requires validation.
Chloroform	18	18	

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Chloromethyl methyl ether	18	18	
Chloroprene	18	18	
2,4-D salts and esters	0010	8270	Applies to esters only.
1,4-Dichlorobenzene	0030	5040, Draft 5041	Qualitative only; boiling point outside directly applicable range of methodology.
1,3-Dichloropropene	18	18	
1,1-Dimethylhydrazine	18	18	
1,4-Dioxane	0030 18	5040, Draft 5041 ^a 18	Analysis of VOST condensate suggested.
1,2-Epoxybutane	18	18	
Ethyl acrylate	18	18	
Ethylbenzene	0030	5040, Draft 5041	Qualitative only; boiling point outside directly applicable range of methodology.
Ethyl chloride	18	18	

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Ethylene dibromide	0030	5040, Draft 5041	Qualitative only; boiling point outside directly applicable range of methodology.
Ethylene dichloride	18	18	
Ethylene imine	18	18	
Ethylene oxide	18	18	
Ethylidene dichloride	18	18	
Formaldehyde	18	18	
Glycol ethers	0010	632	Some members of the class may require HPLC analytical method because of low volatility.
Hexane	18	18	
Hydroquinone	Draft 0011	Draft 8315	
Isophorone	Draft 0011	Draft 8315	
Methyl bromide	18	18	
Methyl chloride	18	18	
Methyl ethyl ketone	0030	5040, Draft 5041 ^a	Analysis of condensate suggested.

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Methyl hydrazine	18	18	
Methyl iodide	18	18	
Methyl isocyanate	18	18	
Methyl methacrylate	18	18	
Methyl tert-butyl ether	18	18	
Methylene chloride	18	18	
Methylene diphenyl diisocyanate	0010	632	HPLC analysis may be required.
Naphthalene	0010	8310	
4-Nitrobiphenyl	0010	8310	
N-Nitroso-N-methylurea	0010	632	HPLC analysis may be required.
N-Nitrosomorpholine	0010	632	HPLC analysis may be required.
Polychlorinated biphenyls	0010	8270	Detection limits much poorer than primary method.
Propionaldehyde	18	18	
Propylene dichloride	18	18	
Propylene oxide	18	18	
1,2-Propyleneimine	18	18	
Quinone	0010	8270	

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Styrene	0030	5040, Draft 5041	Qualitative only; boiling point outside directly applicable range of methodology. Also, styrene is a common decomposition product of Tenax®; blanks may be a problem.
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0010	8280, Draft 8290	
Tetrachloroethylene	0010	8270	Compound is sufficiently volatile to be lost in an extract concentration step.
2,4-Toluenediamine	0010	632	HPLC analysis may be required.
2,4-Toluene diisocyanate	0010	632	HPLC analysis may be required.
1,1,2-Trichloroethane	0010	8270	Compound is sufficiently volatile to be lost in an extract concentration step.
2,2,4-Trimethylpentane	18	18	

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Vinyl acetate	18	18	
Vinyl bromide	18	18	
Vinyl chloride	18 106	18 106	
Vinylidene chloride	18	18	
Xylenes (isomers and mixture)	0030	5040, Draft 5041	Qualitative only; boiling point outside the directly applicable range of the methodology.
o-Xylene	0030	5040, Draft 5041	Qualitative only; boiling point outside the directly applicable range of the methodology.
m-Xylene	0030	5040, Draft 5041	Qualitative only; boiling point outside the directly applicable range of the methodology.
p-Xylene	0030	5040, Draft 5041	Qualitative only; boiling point outside the directly applicable range of the methodology.

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Asbestos	NIOSH 7400	NIOSH 7400	Methodology not directly applicable to stationary sources. Methodology cannot differentiate between asbestos and other mineral fibers.
Arsenic compounds	18	18	Some of the compounds in this category are sufficiently volatile for application of Method 18.
Chlorine	18	18	
Cyanide compounds	9010,9012	9010,9012	
Mineral fibers	NIOSH 7400	NIOSH 7400	Method cannot differentiate between asbestos and other mineral fibers.
Phosphine	18	18	
Lead compounds	12	12	Validated method.
Beryllium compounds	103, 104	103, 104	Validated method.

Table 2

Continued

Compound/Chemical	Sampling	Analysis	Comments
Mercury compounds	101, 101A, 102	101, 101A, 102	Validated method.

^a Method 5040 or Draft 5041 modified to optimize recovery of water-soluble compounds (EPA-600/8-87-008).

^b See Comments, Table i.

possible to perform quantitative sampling and analysis of a particular analyte with a certain methodology. However, this same analyte may also be observed when a different methodology is applied, although not quantitatively analyzed. There may be circumstances in which the qualitative information still has value: recognizing that the data are not quantitative, the user can still obtain some indication of the presence or absence of a given analyte.

The alternative methodology is not necessarily validated, since complete validation of a multi-analyte sampling and analytical methodology would cause the methodology to be selected as a primary methodology. Method 18, for example, is a methodology which has been published in the Federal Register. However, the applicability of this methodology to many Clean Air Act analytes must be established.

2.2 Stationary Source non-Point Emissions

The vast majority of the Methods listed in Tables 1 and 2 are directly applicable to stacks. However, a stationary source is any emission source which does not move. There can be stationary sources which are not stacks, such as vents or ducts. In the sampling and analysis of non-stack stationary sources, the primary methodologies listed in Table 1 can frequently be applied. However, methods developed for the sampling and analysis of ambient air samples may also be applicable with some adaptation or modification. If ambient methodology is applied, appropriate precautions must be taken to ensure that the capacity of the methodology is not exceeded so that results will be quantitative. Table 3 summarizes the methods developed for ambient air sampling which would be applicable to a non-stack stationary source. Care must be taken with all of these methods to avoid saturation: typical ambient concentration levels are low ppbv, whereas some stationary sources can have concentrations at ppmv levels. Ambient methods which require the use of sorbents (see Section 3.0) are susceptible to saturation

of the sorbent if concentration levels are high. If the capacity of the sorbent is saturated, breakthrough will occur and quantitative sampling/analysis cannot be performed.

2.3 Making Use of Collected Information

There are many options for using the information compiled in this report. The two major methodologies in performing stationary source testing for organic compounds are the Volatile Organic Sampling Train (VOST) which is a combination of SW-846 Method 0030 for sampling and SW-846 Method 5040 or SW-846 Draft Method 5041 for analysis and the SemiVolatile Organic Sampling Train (SemiVOST), which is a combination of SW-846 Method 0010 for sampling and SW-846 Method 8270 for analysis. The methods divide according to boiling point: a volatile organic compound for the VOST is any compound with a boiling point less than 100°C, while a semivolatile organic compound for the SemiVOST is any organic compound with a boiling point above 100°C. The Multiple Metals Sampling Train (SW-846 Draft Method 0012) is the methodology most commonly used for sampling and analyzing metals and inorganic compounds. Appendix A can be used as a pathway to an initial decision tree, below.

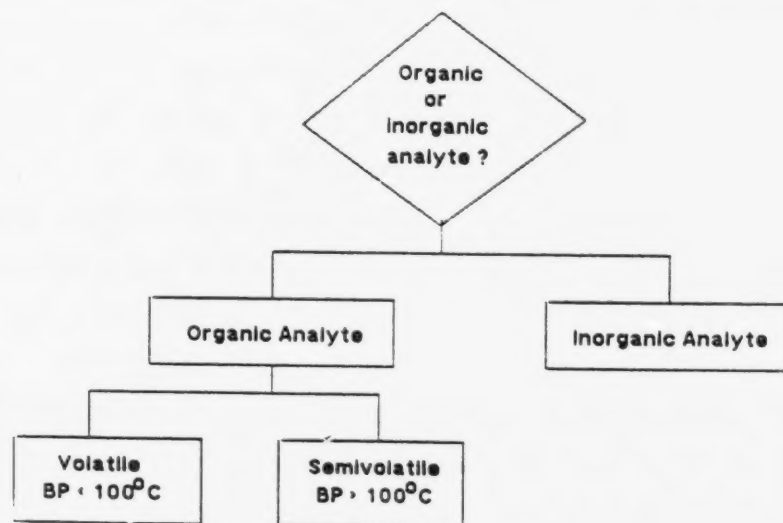


Table 3

Sampling and Analytical Methodology for Stationary Source non-Point Emissions

Compound/Chemical	Sampling and Analysis	Comments
Acetaldehyde	TO-5 TO-11	
Acetamide	TO-13	Modified to use GC/MS.
Acetonitrile	TO-14	
Acetophenone	TO-5 TO-13	Modified to use GC/MS.
2-Acetylaminofluorene	TO-13	Modified to use GC/MS or HPLC.
Acrolein	TO-5 TO-11	
Acrylamide	TO-13	Modified to use GC/MS.
Acrylic acid	TO-13	Modified to use GC/MS; analysis optimized with derivatization.
Acrylonitrile	TO-1 TO-14	
Allyl chloride	TO-1 TO-2 TO-14	
4-Aminobiphenyl	TO-13	Modified to use GC/MS or HPLC.
Aniline	TO-13	Modified to use GC/MS.
o-Anisidine	TO-13	Modified to use GC/MS.
Benzene	TO-1 TO-2 TO-14	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Benzidine	TO-13	Modified to use GC/MS or HPLC.
Benzotrichloride	TO-1 TO-13	Modified to use GC/MS.
Benzyl chloride	TO-1 TO-13	Modified to use GC/MS.
Biphenyl	TO-13	Modified to use GC/MS.
Bis (2-Ethylhexyl) phthalate	TO-13	Modified to use GC/MS; recovery is optimized with acid extraction.
Bis (chloromethyl) ether	TO-1 TO-14	
Bromoform	TO-1 TO-14	
1,3-Butadiene	TO-1 TO-2 TO-14	
Caprolactam	TO-13	Modified to use GC/MS or HPLC.
Captan	TO-4 TO-10	
Carbaryl	TO-13	Modified to use HPLC.
Carbon disulfide	TO-1	Compound may decompose upon standing.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Carbon tetrachloride	TO-1 TO-2 TO-14	
Carbonyl sulfide	TO-1 TO-14	
Catechol	TO-13	Modified to use GC/MS.
Chloramben	TO-13	Modified to use HPLC.
Chlordane	TO-4 TO-10	
Chloroacetic acid	TO-13	Modified to use GC/MS; compound requires derivatization for analysis.
2-Chloroacetophenone	TO-5 TO-11 TO-13	Modified to use GC/MS.
Chlorobenzene	TO-1 TO-14	
Chlorobenzilate	TO-13	Modified to use GC/MS.
Chloroform	TO-1 TO-2 TO-14	
Chloromethyl methyl ether	TO-1 TO-14	
Chloroprene	TO-1 TO-14	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
o-Cresol	TO-8 TO-13	Modified to use GC/MS.
m-Cresol	TO-8 TO-13	Modified to use GC/MS.
p-Cresol	TO-8 TO-13	Modified to use GC/MS.
Cresylic acid	TO-8 TO-13	Modified to use GC/MS.
Cumene	TO-1 TO-13 TO-14	Modified to use GC/MS.
2,4-D salts and esters	TO-10	
DDE	TO-4 TO-10	
Diazomethane	NIOSH 2515	
Dibenzofurans	TO-9	
1,2-Dibromo-3-chloropropane	TO-13	Modified to use GC/MS.
Dibutyl phthalate	TO-13	Modified to use GC/MS.
1,4-Dichlorobenzene	TO-1 TO-13 TO-14	Modified to use GC/MS.
3,3'-Dichlorobenzidine	TO-13	Modified to use HPLC or GC/MS.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Dichloroethyl ether	TO-13	Modified to use GC/MS.
1,3-Dichloropropane	TO-1 TO-14	
Dichlorvos	TO-13	Modified to use GC/MS.
Diethanolamine	TO-13	Modified to use GC/MS or HPLC.
N,N-Diethylaniline	TO-13	Modified to use GC/MS.
Diethyl sulfate	TO-13	Modified to use GC/MS.
3,3'-Dimethoxybenzidine	TO-13	Modified to use GC/MS or HPLC.
Dimethylaminoazobenzene	TO-13	Modified to use GC/MS.
3,3'-Dimethylbenzidine	TO-13	Modified to use GC/MS or HPLC.
Dimethyl carbamoyl chloride	TO-13	Modified to use HPLC.
Dimethyl formamide	TO-13	Modified to use GC/MS or HPLC.
1,1-Dimethylhydrazine	TO-1 TO-14	Compound is unstable.
Dimethyl phthalate	TO-13	Modified to use GC/MS.
Dimethyl sulfate	TO-13	Modified to use GC/MS.
4,6-Dinitro-o-cresol and salts	TO-13	Modified to use HPLC.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
2,4-Dinitrophenol	TO-13	Modified to use GC/MS.
2,4-Dinitrotoluene	TO-13	Modified to use GC/MS.
1,4-Dioxane	TO-1 TO-14	
1,2-Diphenylhydrazine	TO-13	Modified to use GC/MS or HPLC.
Epichlorohydrin	TO-13	Modified to use GC/MS or HPLC.
1,2-Epoxybutane	TO-1 TO-14	
Ethyl acrylate	TO-1 TO-14	Compound is very reactive and polymerizes easily.
Ethylbenzene	TO-1 TO-14	
Ethyl carbamate	TO-13	Modified to use HPLC.
Ethyl chloride	TO-1 TO-2 TO-14	
Ethylene dibromide	TO-1 TO-13 TO-14	Modified to use GC/MS.
Ethylene dichloride	TO-1 TO-2 TO-14	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Ethylene Glycol	TO-13	Modified to use GC/MS or HPLC.
Ethylene imine	TO-1 TO-14	
Ethylene oxide	TO-14	
Ethylene thiourea	TO-13	Modified to use HPLC.
Ethylidene dichloride	TO-1 TO-14	
Formaldehyde	TO-5 TO-11	
Glycol ethers	TO-13	Modified to use GC/MS or HPLC.
Heptachlor	TO-4 TO-10	
Hexachlorobenzene	TO-13	Modified to use GC/MS.
Hexachlorobutadiene	TO-1 TO-13 TO-14	Modified to use GC/MS. May not be quantitative.
Hexachlorocyclopentadiene	TO-13	Modified to use GC/MS.
Hexachloroethane	TO-1 TO-13 TO-14	Modified to use GC/MS.
Hexamethylene-1,6-diisocyanate	TO-13	Modified to use GC/MS or HPLC.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Hexamethylphosphoramide	TO-13	Modified to use GC/MS or HPLC.
Hexane	TO-1 TO-14	
Hydrazine	18	
Hydroquinone	TO-13	Modified to use GC/MS or HPLC.
Isophorone	TO-5 TO-11 TO-13	Modified to use GC/MS.
Lindane	TO-4 TO-10	
Maleic anhydride	TO-13	Modified to use GC/MS or HPLC.
Methanol	TO-14	GC/MD.
Methoxychlor	TO-4 TO-10 TO-13	Modified to use GC/MS or HPLC.
Methyl bromide	TO-1 TO-2 TO-14	Breakthrough problem.
Methyl chloride	TO-1 TO-2 TO-14	Breakthrough problem.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Methyl chloroform	TO-1 TO-2 TO-14	
Methyl ethyl ketone	TO-1 TO-5 TO-11 TO-14	
Methyl hydrazine	TO-1 TO-14	
Methyl iodide	TO-1 TO-14	
Methyl isobutyl ketone	TO-1 TO-5 TO-11 TO-14	
Methyl isocyanate	TO-1 TO-14	
Methyl methacrylate	TO-1 TO-14	
Methyl tert-butyl ketone	TO-1 TO-5 TO-11 TO-14	
4,4'-Methylene bis (2-chloroaniline)	TO-13	Modified to use GC/MS or HPLC.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Methylene chloride	TO-1 TO-2 TO-14	
Methyl diphenyl diisocyanate	TO-13	Modified to use GC/MS or HPLC.
4,4'-Methylene dianiline	TO-13	Modified to use GC/MS or HPLC.
Naphthalene	TO-13	Modified to use GC/MS or HPLC.
Nitrobenzene	TO-1 TO-14	
4-Nitrobiphenyl	TO-13	Modified to use GC/MS or HPLC.
4-Nitrophenol	TO-13	Modified to use GC/MS.
2-Nitropropane	TO-1 TO-13 TO-14	Modified to use GC/MS.
N-Nitroso-N-methylurea	TO-13	Modified to use GC/MS or HPLC.
N-Nitrosodimethylaniline	TO-1 TO-7 TO-13	Very reactive. Modified to use GC/MS or HPLC.
N-Nitrosomorpholine	TO-7 TO-13	Modified to use GC/MS or HPLC.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Parathion	TO-4 TO-10	
Pentachloronitrobenzene	TO-13	Modified to use GC/MS or HPLC.
Pentachlorophenol	TO-13	Modified to use GC/MS or HPLC.
Phenol	TO-13	Modified to use GC/MS.
p-Phenylenediamine	TO-13	Modified to use GC/MS or HPLC.
Phosgene	TO-6	
Phthalic anhydride	TO-13	Modified to use GC/MS.
Polychlorinated biphenyls	TO-13 with 680 or 8080	
1,3-Propane sultone	TO-13	Modified to use GC/MS.
beta-Propiolactone	TO-13	Modified to use GC/MS.
Propionaldehyde	TO-5 TO-11	
Propoxur	TO-13	Modified to use HPLC.
Propylene dichloride	TO-1 TO-14	
Propylene oxide	TO-1 TO-14	
1,2-Propyleneimine	TO-1 TO-14	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Quinoline	TO-13	Modified to use GC/MS.
Quinone	TO-5 TO-11	
Styrene	TO-1 TO-14	
Styrene oxide	TO-13	Modified to use GC/MS.
2,3,7,8-Tetrachlorodibenzo- p-dioxin	TO-9	
1,1,2,2-Tetrachloroethane	TO-1 TO-14	
Tetrachloroethylene	TO-1 TO-14	
Toluene	TO-1 TO-2 TO-14	
2,4-Toluene diamine	TO-13	Modified to use GC/MS or HPLC.
2,4-Toluene diisocyanate	TO-13	Modified to use GC/MS or HPLC.
o-Toluidine	TO-13	Modified to use GC/MS or HPLC.
Toxaphene	TO-4 TO-10	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
1,2,4-Trichlorobenzene	TO-1 TO-13	Modified to use GC/MS.
1,1,2-Trichloroethane	TO-1 TO-14	
Trichloroethylene	TO-1 TO-2 TO-14	
2,4,5-Trichlorophenol	TO-13	Modified to use GC/MS.
2,4,6-Trichlorophenol	TO-13	Modified to use GC/MS.
Triethylamine	TO-13	Modified to use GC/MS or HPLC.
Trifluralin	TO-4 TO-10	
2,2,4-Trimethylpentane	TO-1 TO-14	
Vinyl acetate	TO-1 TO-14	
Vinyl bromide	TO-1 TO-2 TO-14	Breakthrough may be a problem.
Vinyl chloride	TO-1 TO-2 TO-14	Breakthrough may be a problem.

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Xylenes (isomers and mixture)	TO-1 TO-14	
o-Xylene	TO-1 TO-14	
m-Xylene	TO-1 TO-14	
p-Xylene	TO-1 TO-14	
Antimony compounds	Draft 0012	
Asbestos	CARB 427 NIOSH 7400	
Arsenic compounds	Draft 0012	
Beryllium compounds	Draft 0012	
Cadmium compounds	Draft 0012	
Calcium cyanamide		
Chlorine	OSHA ID-101	
Chromium compounds	Draft 0012	
Cobalt compounds	Draft 0012	
Coke oven emissions	109	For visible emissions.
Cyanide compounds	NIOSH 7904/9010, 9012	Impinger solution modified to dilute (0.1 N) KOH

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Hydrochloric acid	18 26	
Hydrogen Fluoride	14 18	
Lead compounds	Draft 0012	
Manganese compounds	Draft 0012	
Mercury compounds	Draft 0012	
Mineral fibers	CARB 427	Does not differentiate between mineral fibers and asbestos.
	NIOSH 7400	
Nickel compounds	Draft 0012	
Phosphine	Draft 0012 18	
Phosphorus	Draft 0012	
Polycyclic organic matter	TO-13	Modified to use GC/MS or HPLC.
Radionuclides	0020/EPA Docket No. A- 79-11	Method will detect gaseous and particulate forms.
Selenium compounds	Draft 0012	

Table 3

Continued

Compound/Chemical	Sampling and Analysis	Comments
Titanium tetrachloride	Draft 0012 13A or B	Method measures total titanium, not species; compound decomposes at ambient moisture levels.

Information presented in Table 1 will give information on the tentative assignment of the volatile, semivolatile, or inorganic analyte to a combined sampling/analytical methodology. With the summary information presented in Table 1, the sampling and analytical methodology can be examined to determine the range of applicability of the methods and any difficulties which might be expected with the analyte in using the tentatively assigned methodology. Other decision trees will be possible on the basis of information from Table 1 and from the discussions of the sampling and analytical methods (see Figure 1 and Figure 2). The Figures provide only a general guideline, however, and several checks must be made to be sure that the methodology will be applicable. After a tentative methodology is identified, Section 3.0, which contains a summary of the method, with a description of the analytes from the Clean Air Act Amendments to which the methodology ought to be applicable, must be checked to be sure that the tentative method is appropriate. With such a broad range of analytes, many methods must be modified or adapted for reasonable results. For example, a polar water-soluble organic compound with boiling point less than 100°C requires adaptation of Method 5040 or Draft Method 5041 for any hope of successful analysis.

2.4 Validation of Proposed Methodology

Methodology without validation data can be used only for screening purposes. Validated methodology should be used, whenever possible, to generate data to determine regulatory compliance. Table 1 identifies many analytes which require validation of the sampling and analytical methodology. Some analytes indicate that they are a "target compound" for SW-846 Method 8270. A "target compound" for Method 8270 is an organic compound for which the analytical methodology has been validated: that is, the precision and bias of the analytical methodology have been established in an interlaboratory study. However, validation of the analytical methodology determines

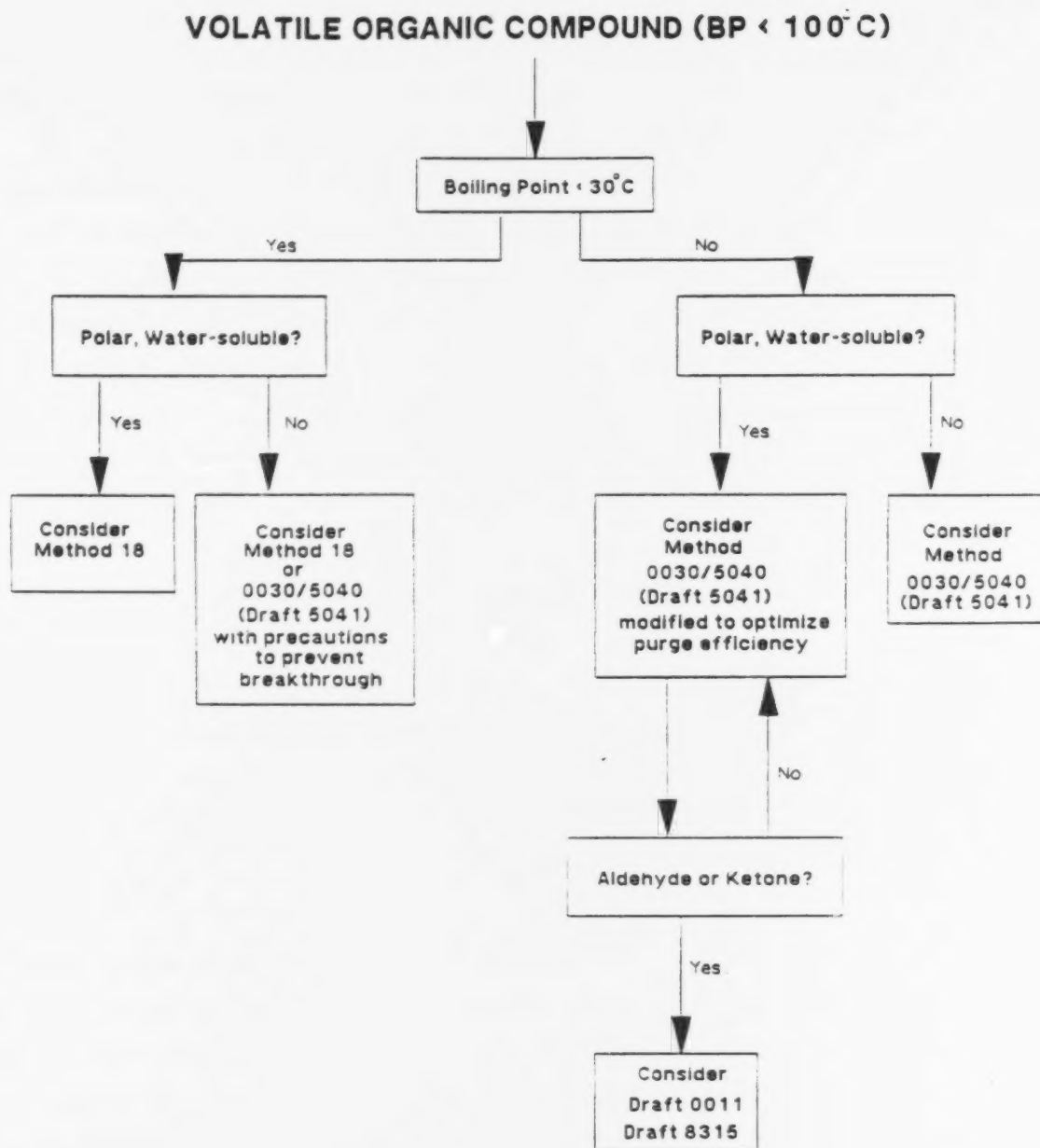


Figure 1. Volatile Organic Compounds

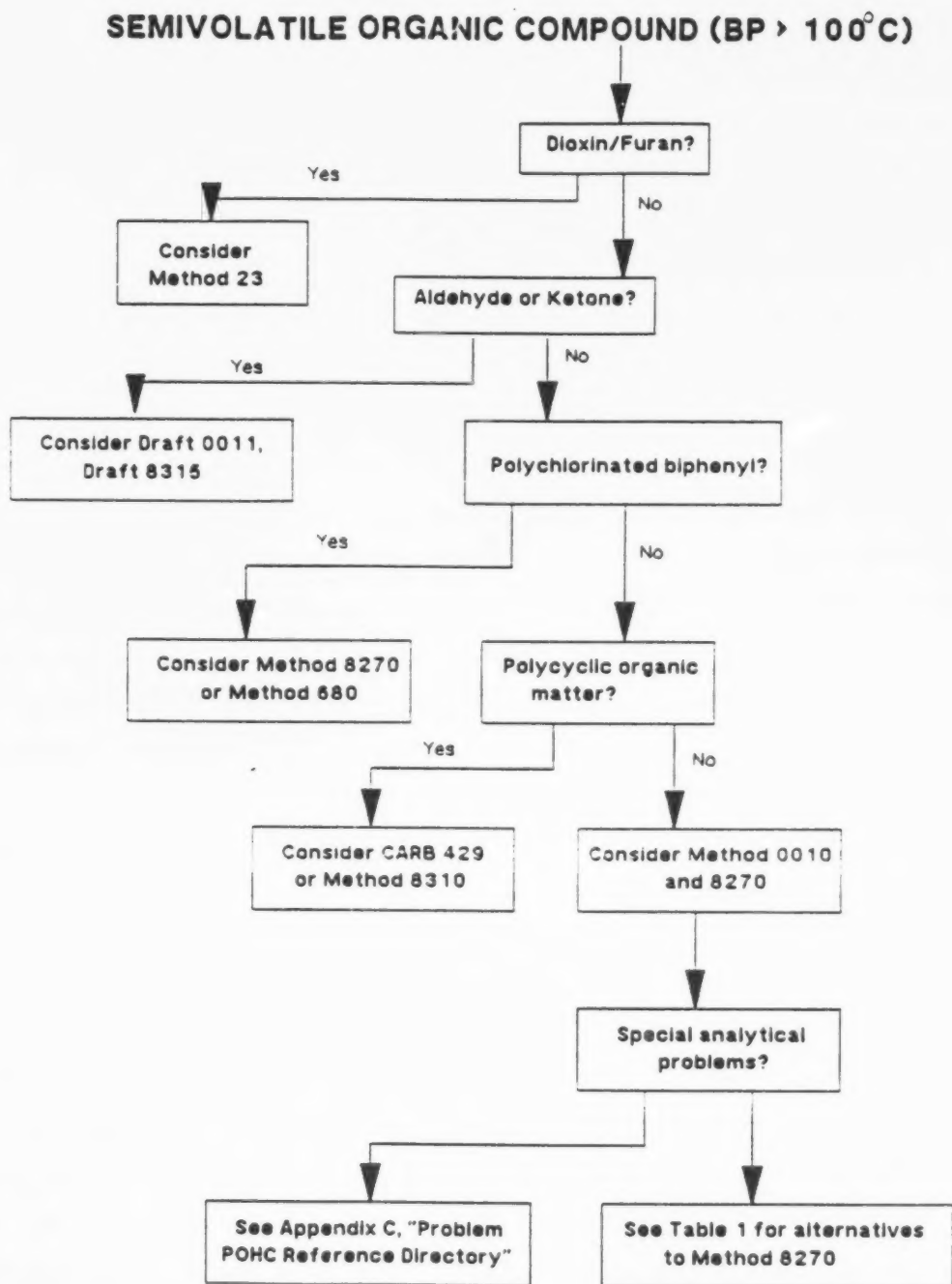


Figure 2. Semivolatile Organic Compounds

only that if the compound is introduced to the analytical instrument, a successful analysis can be performed. Successful analysis does not mean or even imply that successful sampling can be performed; the successful functioning of the field sampling methodology must be demonstrated and documented.

If a validated method is required for a given analyte, a source owner or operator must validate a proposed methodology to generate data which will meet EPA requirements. A procedure for performing this validation is available from EPA ("Protocol for the Field Validation of Emission Concentrations from Stationary Sources," Method 301). This protocol states that if EPA currently recognizes an appropriate test method or considers a proposed test method to be satisfactory for a particular source, the Administrator may waive the use of the validation protocol or may specify a less rigorous validation procedure. The list of validated methods from the Federal Register includes Methods 1 through 28A. Where these methods are applicable to analytes from the Clean Air Act Amendments, they are usually applicable to only a single analyte or, at most, a small group of analytes. Since the goal of this program was to make the sampling and analytical methodology as broad as possible, these validated methods are not used extensively in Table 1. As a general observation, the sampling and analytical methodology cited in Table 1 does not, except for a few analytes, have a known precision and bias for a given analyte at a particular type of source. The need for validation of the proposed methodology, or the availability of partial validation information, is indicated in Table 1.

Bias is any systematic positive or negative difference between the measured value and the true value of a sample. Bias is established by comparing the results obtained from the application of the method against a reference value. Precision is the variability in the data obtained from the entire measurement system (both sampling and analysis) as determined from collocated sampling trains. At least two paired sampling trains must

be used in order to establish precision. Standards for an acceptable level of bias and precision are given in the Validation Protocol, and exact procedures for determination of bias and precision and calculating the values are presented. Bias and precision can also be determined when an alternative method to a validated method is being proposed. In general, spiking of the analyte in the field must be performed (an isotopically-labeled analyte may be used if gas chromatography/mass spectrometry is the ultimate analytical method), and replicate samples must be taken and analyzed. The field validation must incorporate:

- Summary of appropriate precision and bias calculations;
- Certification for the reference material(s) used and the value(s);
- Results from a performance audit, if performed, or an explanation of the inability to perform an audit;
- Results of the laboratory demonstration of the quality of the spiking system;
- A discussion of the laboratory evaluations;
- A discussion of the field sampling;
- A discussion of sample preparation and analysis;
- A report of the storage times of samples and/or extracts; and
- A discussion of the reasons for the elimination of any results.

There are many conditions under which a waiver from the Validation Protocol may be obtained. These conditions and the procedure for application for a waiver are described in the Validation Protocol.

2.5 Quality Assurance/Quality Control (QA/QC) Procedures

If appropriate Quality Assurance and Quality Control procedures are followed in the determination of emissions from stationary sources, the level of precision and accuracy will be documented, and acceptance limits for the precision and accuracy will be defined. If appropriate Quality Control information is included as part of the final data report, the process of reviewing the results will be straightforward and effective. The general format and required topics in a Quality Assurance Project Plan are presented in "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (EPA QAMS-005/80, December 29, 1980). The points which must be addressed in the Quality Assurance Project Plan relative to the generation of data include:

- Quality Assurance objectives for measurement data in terms of precision, accuracy, completeness, representativeness, and comparability;

Completeness is the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under optimal normal conditions.

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition.

Comparability expresses the confidence with which one data set can be compared to another.

- Sampling procedures;
- Sample custody;
- Calibration procedures and frequency (for both laboratory and field operations);

- Analytical procedures;

Modifications of standard methods must be identified, with reasons for the changes.

- Data reduction, validation, and reporting;
- Internal quality control checks and frequency;
- Performance and systems audits and frequency;
- Preventive maintenance procedures and schedules;
- Specific routine procedures to be used in the assessment of data precision, accuracy, and completeness of specific measurement parameters; and
- Corrective action to be taken in case problems are encountered at any stage of the sampling, analytical, or reporting procedures.

In general, Quality Control procedures for sampling and analysis of volatile organic compounds (boiling point < 100°C) must consider the following elements:

- Results for blanks;
- Calibration of the analytical system(s);
- Performance of the sampling/analytical method at the level of 99.99% Destruction and Removal Efficiency;

Establish prior to taking samples that the analytical methodology is capable of sufficient sensitivity to detect and quantify the analyte at the expected concentration level which will be encountered for the stationary source.

- Determination of accuracy and precision;

Replicate spiking studies at the expected concentration level for the analyte must be performed to demonstrate the reproducibility and accuracy of the methodology.

- Assessment of method accuracy using calibration check standards and surrogate compounds;
- Breakthrough ratios of analytes on sorbent, if sorbents are used; and
 Sampling is not quantitative if the capacity of the sorbent exceeded.
- Determination of detection limits.

Quality control procedures for sampling and analysis of semivolatile organic compounds (boiling points $> 100^{\circ}\text{C}$) must consider the following elements:

- Demonstration of method performance at the 99.99% Destruction and Removal Efficiency level;
- Calibration of the analytical system;
- Assessment of method accuracy using calibration check standards, surrogate compounds, and spiked samples;
- Determination of method precision by analysis of replicate samples;
- Determination of the detection limit for the analytical methodology; and
- Analysis of appropriate laboratory and field blanks.

The following quality control elements must be considered in metals sampling and analysis:

- Definition of the need for analysis of metals, the definition of metal analytes of interest, and the concentration limits for regulatory purposes;
- Determination of the accuracy of the analytical procedures by use of calibration check samples, reference materials, and spiked samples;

- Assessment of method precision by preparation and analysis of replicate samples; and
- Determination of the method detection limit for a given matrix.

Sampling and analytical procedures presently available do not speciate inorganic compounds. Development of methodology is required for speciation of inorganic compounds. In addition, for each analytical method, there are specific quality control procedures which address the identification of analytes and performance of correct quantitative calculations to determine the concentration of the analytes in samples which have been taken in the field at a stationary source.

SECTION 3.0

DESCRIPTIONS OF METHODS

This section contains a short description of each of the methods listed in Table 1. Each description includes:

- The scope and application of the methodology;
- A short summary of the method;
- Interferences, including matrix problems, if any are known;
- Method target compounds: i.e., all compounds for which the methodology is validated; and
- Applicable CAA Amendments Pollutants: i.e., hazardous air pollutants listed in the CAA Amendments to which the methodology may be applied.

EPA METHOD 0010

Modified Method 5 Sampling Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 0010 is used to determine the Destruction and Removal Efficiency (DRE) of semivolatile principal organic hazardous constituents (POHCs) from incineration systems. This method may also be used to determine particulate emission rates from stationary sources, as per EPA Method 5 (see the Reference Table included in the description of Method 0010 in SW-846). Method 0010 has been applied to semivolatile compounds, including polychlorinated biphenyls (PCBs), chlorinated dibenzodioxins and dibenzofurans, polycyclic organic matter, and other semivolatile organic compounds.

2.0 SUMMARY OF METHOD

Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and collected in a multicomponent sampling train. Principal components of the train include a high-efficiency glass- or quartz-fiber filter and a packed bed of porous polymeric adsorbent resin (typically XAD-2® or polyurethane foam for PCBs). The filter is used to collect organic-laden particulate materials and the porous polymeric resin to adsorb semivolatile organic species (compounds with a boiling point above 100°C).

Comprehensive chemical analyses, using a variety of applicable analytical methodologies, are conducted to determine the identity and concentration of the organic materials.

3.0 INTERFERENCES

Oxides of nitrogen (NO_x) are possible interferents in the determination of certain water-soluble compounds such as 1,4-dioxane, phenol, and urethane. Reaction of these compounds with NO_x in the presence of moisture will reduce their concentration. Other chemical reactions are possible, since SO_2 , O_3 , and other reactive species may be present in the emissions. Other problems that could produce a positive or a negative bias, depending upon the compounds of interest, are:

- Stability of the compound of interest in methylene chloride, since at least one of the common analytical methods relies upon methylene chloride extraction of the sorbent media from the sampling train;
- Formation of water-soluble organic salts on the resin in the presence of moisture (compounds that form water-soluble salts can be recovered by appropriate control of pH during the extraction process); and
- Solvent-extraction efficiency of water-soluble compounds from aqueous media.

When gas chromatography/mass spectrometry is used as the analytical technique, compounds that coelute chromatographically can frequently be deconvoluted if their mass spectra are different. Using two or more ions per compound in quantitative analysis can overcome interference at one mass; however, if the concentration of the compound of interest is sufficient to saturate the detector at a given mass, an alternative mass MAY NOT be selected. In this case, the extract must be diluted to bring the concentration of the compound of interest into the calibration range in order to obtain accurate quantitative analysis.

4.0 METHOD TARGET COMPOUNDS

Method 0010 is an extremely powerful and versatile methodology. A single analytical methodology cannot simultaneously address all semivolatile compounds for which Method 0010 might serve as a sampling methodology. Appropriate target compounds are listed under the pertinent analytical methodology in Table 1. Method detection limits are a function of volume sampled, and the volume that is sampled will also vary according to the analyte.

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

- acetamide (Method 8270)*
- acetophenone (Method 8270; 8270 target)
- 2-acetylaminofluorene (Method 8270)
- acrylamide (Method 8270)
- acrylic acid (Method 8270 with derivatization)
- 4-aminobiphenyl (Method 8270; 8270 target)
- aniline (Method 8270; 8270 target)
- o-anisidine (Method 8270)
- benzidine (Method 8270; 8270 target)
- benzotrichloride (Method 8270)
- benzyl chloride (Method 8270)
- biphenyl (Method 8270; also Method 8310)
- bis (2-ethylhexyl) phthalate (Method 8270; 8270 target)
- bromoform (Method 8270)
- caprolactam (Method 632)
- captan (Method 8270)
- carbaryl (Method 632)
- catechol (Method 8270)

chloramben (Method 515/615)
chlordan (Method 8270; 8270 target)
chloroacetic acid (Method 8270 with derivatization)
2-chloroacetophenone (Method 8270)
chlorobenzene (Method 8270)
chlorobenzilate (Method 8270)
o-cresol (Method 8270; 8270 target)
m-cresol (Method 8270)
o-cresol (Method 8270; 8270 target)
cresylic acid (mixture of cresol isomers; Method 8270)
cumene (Method 8270)
2,4-D salts and esters (2,4-D, Method 8270; 8270 target; salts and esters.
Method 515/615)
DDE (Method 8270; 8270 target)
dibenzofurans (Method 8280, Method 8290)
1,2-dibromo-3-chloropropane (Method 8270)
dibutyl phthalate (Method 8270; 8270 target)
1,4-dichlorobenzene (Method 8270; 8270 target)
3,3'-dichlorobenzidine (Method 8270; 8270 target)
dichloroethyl ether (Method 8270)
1,3-dichloropropene (Method 8270)
dichlorvos (Method 8270)
diethanolamine (Method 8270, possibly Method 632)
N,N-diethylaniline (Method 8270)
diethyl sulfate (Method 8270)
3,3'-dimethoxybenzidine (Method 8270)
dimethylaminoazobenzene (Method 8270; 8270 target)
3,3'-dimethylbenzidine (Method 8270)
dimethyl carbamoyl chloride (Method 531)

dimethyl formamide (Method 8270)
dimethyl phthalate (Method 8270; 8270 target)
dimethyl sulfate (Method 8270)
4,6-dinitro-*o*-cresol and salts (Method 8270 for 4,6-dinitro-*o*-cresol;
Method 515/615 for 4,6-dinitro-*o*-cresol and salts)
2,4-dinitrophenol (Method 8270; 8270 target)
2,4-dinitrotoluene (Method 8270; Method 8270 target)
1,4-dioxane (Method 8270)
1,2-diphenylhydrazine (Method 8270; 8270 target)
epichlorohydrin (Method 8270)
ethylbenzene (Method 8270)
ethyl carbamate (Method 632)
ethylene dibromide (Method 8270)
ethylene glycol (Method 8270)
ethylene thiourea (Method 632)
glycol ethers (Method 8270)
heptachlor (Method 8270; 8270 target)
hexachlorobenzene (Method 8270; 8270 target)
hexachlorobutadiene (Method 8270; 8270 target)
hexachlorocyclopentadiene (Method 8270; 8270 target)
hexachloroethane (Method 8270; 8270 target)
hexamethylene-1,6-diisocyanate (Method 8270)
hexamethylphosphoramide (Method 632)
hydroquinone (Method 8270)
isophorone (Method 8270; 8270 target)
lindane (Method 8270)
maleic anhydride (Method 8270)
methoxychlor (Method 8270; 8270 target)
methyl isobutyl ketone (Method 8270)

4,4'-methylene bis(2-chloroaniline) (Method 8270)
methylene diphenyl isocyanate (Method 8270 or Method 632)
4,4'-methylenedianiline (Method 8270)
naphthalene (Method 8270; 8270 target; also Method 8310)
nitrobenzene (Method 8270; 8270 target)
4-nitrobiphenyl (Method 8270; also Method 8310)
4-nitrophenol (Method 8270; 8270 target)
2-nitropropane (Method 8270)
N-nitroso-N-methylurea (Method 8270, possibly Method 632)
N-nitrosodimethylamine (Method 8270; 8270 target)
N-nitrosomorpholine (Method 8270, possibly Method 632)
parathion (Method 8270)
pentachloronitrobenzene (Method 8270; 8270 target)
pentachlorophenol (Method 8270; 8270 target)
phenol (Method 8270; 8270 target)
p-phenylenediamine (Method 8270)
phthalic anhydride (Method 8270)
polychlorinated biphenyls (Method 8270 with very high detection limits;
Method 680)
1,3-propane sultone (Method 8270)
beta-propiolactone (Method 8270)
propoxur (Method 632)
quinoline (Method 8270)
quinone (Method 8270)
styrene (Method 8270)
styrene oxide (Method 8270)
2,3,7,8-tetrachlorodibenzodioxin (Method 8280, Method 8290)
1,1,2,2-tetrachloroethane (Method 8270)
tetrachloroethylene (Method 8270)

toluene (Method 8270)
2,4-toluenediamine (Method 8270, Method 632)
2,4-toluenediisocyanate (Method 8270, Method 632)
o-toluidine (Method 8270)
toxaphene (Method 8270; 8270 target)
1,2,4-trichlorobenzene (Method 8270)
1,1,2-trichloroethane (Method 8270)
2,4,5-trichlorophenol (Method 8270; 8270 target)
2,4,6-trichlorophenol (Method 8270; 8270 target)
trifluralin (Method 8270)
xylenes: o-xylene, m-xylene, p-xylene (Method 8270)
polycyclic organic matter (Method 8270; Method 8310)

▪ The appropriate analytical methodology for each pollutant is shown in parenthesis.

EPA DRAFT METHOD 0011

Sampling for Formaldehyde Emissions from Stationary Sources

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 0011 is used to determine the Destruction and Removal Efficiency (DRE) of formaldehyde. Although this methodology has been applied specifically to formaldehyde, many laboratories have extended the application to other aldehydes and ketones. Compounds derivatized with 2,4-dinitrophenylhydrazine (DNPH) can be detected in concentrations as low as 6.4×10^{-8} lbs/cu ft (1.8 ppbv) in 40 cu ft of stack gas sampled over a 1-hour period.

2.0 SUMMARY OF METHOD

Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in aqueous acidic DNPH solution. Formaldehyde (and other aldehydes and ketones) present in the emissions reacts with DNPH to form the dinitrophenylhydrazone derivative. The dinitrophenylhydrazone derivative is extracted, solvent-exchanged, concentrated, and then analyzed by high-performance liquid chromatography.

3.0 INTERFERENCES

A chromatographic method is subject to interference from coeluting components of the matrix. A decomposition product of DNPH, 2,4-dinitroaniline, can be an analytical interferent if concentrations are high. High concentrations of oxygenated compounds, especially acetone, that have the same retention time or nearly the same retention time as the dinitrophenylhydrazone of formaldehyde and that also absorb at 360 nm will interfere with the analysis. Contamination of the aqueous acidic DNPH reagent with formaldehyde and 2,4-dinitroaniline is frequently encountered. The reagent must be prepared within five days of field use and must be stored in an uncontaminated environment both before and after sampling in order to minimize blank problems. Because acetone is ubiquitous in laboratory and field operations, some level of acetone contamination is unavoidable; however, it must be minimized to the extent possible.

4.0 METHOD TARGET COMPOUNDS

Aldehydes

Ketones

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetophenone

acrolein

2-chloroacetophenone

formaldehyde

isophorone

methyl ethyl ketone

methyl isobutyl ketone

propionaldehyde

quinone

EPA METHOD 0012

Multi-Metal Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 0012 is used to determine metals from municipal waste incinerators and similar combustion processes. In addition, the method may be modified to determine particulate emissions.

2.0 SUMMARY OF METHOD

Method 0012 consists of a stack sampling train and a number of analysis techniques for the recovered samples. The source sample is withdrawn isokinetically from the stack through a heated probe. The majority of the particulate emissions are collected on a filter in a heated filter holder that is located after the probe outside the stack. The gaseous emissions are collected in a series of chilled impingers located after the filter. Two of the impingers contain dilute nitric acid in hydrogen peroxide, and one or two contain acidic potassium permanganate solution.

Sample train components are recovered and digested in acid as separate fractions. The impingers and digested probe and filter solutions are analyzed for mercury by cold vapor atomic absorption spectroscopy. All the sampling train components, except the permanganate solution, can be analyzed by inductively coupled argon plasma emission

spectroscopy (ICAP) or atomic absorption spectroscopy (AAS). Graphite furnace atomic spectroscopy (GFAAS) is used for analysis of arsenic, cadmium, lead, antimony, selenium, and thallium if greater analytic sensitivity is required. For convenience, AAS may be used to analyze for all metals and/or a combined sample in a single analytical determination, provided the resulting detection limits meet the data quality objectives of the testing program. Detection limits for the target compounds range from 0.11 to 27 $\mu\text{g}/\text{m}^3$ for all methods except GFAAS. For selected metals, detection limits range from 0.03 to 0.8 $\mu\text{g}/\text{m}^3$ with GFAAS.

3.0 INTERFERENCES

Organic interferences will be removed with complete digestion. Use of the train to quantify particulate emissions may impact on mercury determinations, although data acquired to date show that less than 2 percent of the mercury is lost in the particulate catch.

Iron can be a spectral interference during analysis of arsenic, chromium, and cadmium by ICAP. Aluminum can be a spectral interference during the analysis of arsenic and lead by ICAP. Matrix modifiers should be used to eliminate interferences in all GFAAS analyses. Refer to EPA Method 6010 (SW-846) for details on potential interferences.

4.0 METHOD TARGET COMPOUNDS

arsenic *

barium **

beryllium *

cadmium^{*}
chromium^{*}
copper^{**}
lead^{*}
manganese^{**}
mercury^{*}
nickel^{*}
phosphorus^{**}
selenium^{**}
silver^{**}
thallium^{**}
zinc^{*}

^{*}Primary target compounds

^{**}Secondary target compounds

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

NOTE: Draft Method 0012 analytical methods do not speciate inorganic compounds.

antimony compounds
arsenic compounds
beryllium compounds
cadmium compounds
chromium compounds
cobalt compounds
lead compounds
manganese compounds
mercury compounds

nickel compounds
selenium compounds
titanium tetrachloride

EPA METHOD 0030

Volatile Organic Sampling Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 0030 is used to calculate destruction and removal efficiency (DRE) of volatile principal organic hazardous constituents (POHCs) from stack gas effluents of hazardous waste incinerators, and enable a determination that DRE values are equal to or greater than 99.99 percent. For the purpose of definition, volatile POHCs are those POHCs with boiling points less than 100°C. If the boiling point of a POHC of interest is less than 30°C, the POHC may break through the sorbent under the conditions of the sample collection procedure.

2.0 SUMMARY OF METHOD

A 20-L sample of effluent gas is withdrawn from an emission source at a flow rate of 1 L/min, using a glass-lined probe and a volatile organic sampling train (VOST). The gas stream is cooled to 20°C by passage through a water-cooled condenser and volatile POHCs are collected on a pair of sorbent resin traps. Liquid condensate is collected in an impinger placed between the two resin traps. The first resin trap (front trap) contains approximately 1.6 g Tenax® and the second trap (back trap) contains approximately 1 g each of Tenax® and petroleum-based charcoal (SKC lot 104 or equivalent), 3:1 by volume.

An alternative set of conditions for sample collection has been used. This method involves collecting a sample volume of 20 L or less at a reduced flow rate. (Operation of the VOST under these conditions has been referred to as SLO-VOST.) This method has been used to collect 5 L of sample (250 mL/min for 20 min) or 20 L of sample (500 mL/min for 40 min) on each pair of sorbent cartridges. Smaller sample volumes collected at lower flow rates should be considered when the boiling points of the POHCs of interest are below 35°C.

3.0 INTERFERENCES

The sensitivity of this method depends on the level of interferences in the sample and the presence of detectable levels of volatile POHCs in the blanks. The target detection limit of this method is $0.1 \mu\text{g}/\text{m}^3$ (ng/L) of flue gas, to permit calculation of a DRE equal to or greater than 99.99 percent for volatile POHCs that may be present in the waste stream at 100 ppm. The upper end of the range of applicability of this method is limited by breakthrough of the volatile POHCs on the sorbent traps used to collect the sample. Laboratory development data have demonstrated a range of 0.1 to $100 \mu\text{g}/\text{m}^3$ (ng/L) for selected volatile POHCs collected on a pair of sorbent traps using a total sample volume of 20 L or less. Interferences arise primarily from background contamination of sorbent traps prior to or after use in sample collection. Many interferences can be due to exposure of the sorbent materials to solvent vapors prior to assembly and exposure to significant concentrations of volatile POHCs in the ambient air at hazardous waste incinerator sites. A sufficiently high background level in the source (for example, a THC level above 100 ppm) can make trace analysis in the samples impossible.

4.0 METHOD TARGET COMPOUNDS

None

5.0 APPLICABLE CLEAN AIR ACT LIST OF CHEMICALS

acetaldehyde⁺⁺
acetonitrile⁺⁺
acrolein⁺⁺
acrylonitrile⁺⁺
allyl chloride^{*}
benzene^{*}
bromoform^{***}
carbon disulfide^{*}
carbon tetrachloride^{*}
chlorobenzene (validated)^{***}
chloroform^{*}
chloromethyl methyl ether⁺⁺
chloroprene^{*}
cumene^{***}
1,4-dichlorobenzene^{***}
1,3-dichloropropene^{***}
1,1-dimethylhydrazine⁺⁺
1,4-dioxane⁺⁺
epichlorohydrin⁺⁺
1,2-epoxybutane⁺⁺
ethyl acrylate⁺⁺
ethylbenzene^{***}
ethyl chloride^{**}

ethylene dibromide***
ethylene dichloride*
ethylidene dichloride*
hexane*
methyl bromide**
methyl chloride**
methyl chloroform*
methyl ethyl ketone++
methyl hydrazine++
methyl iodide*
methyl isobutyl ketone++
methyl isocyanate++
methyl methacrylate++
methyl tert-butyl ether++
methylene chloride*
propionaldehyde++
propylene dichloride*
propylene oxide++
1,2-propylene imine++
styrene***
1,1,2,2-tetrachloroethane***
tetrachloroethylene (validated)***
toluene (validated)***
1,1,2-trichloroethane***
trichloroethylene*
2,2,4-trimethylpentane*
vinyl acetate++
vinyl bromide**
vinyl chloride (validated)**

vinylidene chloride*

xylenes***

o-xylene***

m-xylene***

p-xylene***

- * Boiling point between 35°C and 100°C. Should work well with this methodology.
- ** Special precautions must be taken to avoid breakthrough when these compounds are analytes.
- *** Boiling point above 100°C. Can be observed using VOST methodology but VOST should not be used to provide quantitative data unless specific validation is performed.
- ++ Polar and/or water soluble. In general, perform well in the VOST methodology. Recovery can be improved by modifying the standard purge and trap analytical method by elevating the purge temperature to 60°C and adding 1 g of sodium chloride or sodium sulfate to condensate before purging (see EPA-600/8-87-008). With modified analytical methodology, the VOST methodology may be applicable to these compounds (validation required before use of the methodology to generate regulatory data).

EPA DRAFT METHOD 0050

Isokinetic HCl/Cl₂ Emission Sampling Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U. S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 0050 is used to collect hydrogen chloride (HCl) and chlorine (Cl₂) in stack gas emission samples from hazardous waste incinerators, municipal waste combustors, and boilers and industrial furnaces. Collected samples are analyzed using EPA Method 9057. Method 0050 collects the emission sample isokinetically and is therefore, particularly suited for sampling at sources, such as those controlled by wet scrubbers, that emit acid particulate matter (e.g., HCl dissolved in water droplets). Method 0050 is not acceptable for demonstrating compliance with HCl emission standards less than 20 ppm. This method may also be used to collect samples for subsequent determination of particulate emissions (EPA Method 5).

2.0 SUMMARY OF METHOD

Gaseous and particulate pollutants are withdrawn from an emission source and are collected in an optional cyclone, on a filter, and in absorbing solutions. The cyclone collects any liquid droplets. The cyclone is not required if the source emissions do not contain liquid droplets (See EPA Method 0051). The Teflon® mat or quartz-fiber filter collects other particulate matter, including chloride salts. Acidic and alkaline absorbing solutions collect gaseous HCl and Cl₂, respectively. Following sampling of emissions

containing liquid droplets, any HCl/Cl₂ dissolved in the liquid in the cyclone and/or on the filter is vaporized and ultimately collected in the impingers by pulling Ascarite II®-conditioned ambient air through the sampling train. In the acidified water absorbing solution, the HCl gas is solubilized and forms chloride ions. The Cl₂ gas present in the emissions has a very low solubility in acidified water and passes through to the alkaline absorbing solution where it undergoes hydrolysis to form a proton (H⁺), chloride ions, and hypochlorous acid (HClO). Chloride ions in the separate solutions are measured by ion chromatography (EPA Method 9057). If desired, the particulate matter recovered from the filter and the probe can be analyzed (EPA Method 5).

3.0 INTERFERENCES

Volatile materials that produce chloride ions upon dissolution during sampling are interferences in the measurement of HCl. Cl₂ disproportionates to HCl and HClO upon dissolution in water, and will interfere with the HCl analysis. Cl₂ exhibits a low solubility in water, however, and the use of acidic rather than neutral or basic solutions for collection of HCl greatly reduces the dissolution of any Cl₂ present.

4.0 METHOD TARGET COMPOUNDS

chlorine
hydrogen chloride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

chlorine
hydrogen chloride

EPA DRAFT METHOD 0051

Midget Impinger HCl/Cl₂ Emission Sampling Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U. S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 0051 is used to collect hydrogen chloride (HCl) and chlorine (Cl₂) in stack gas emission samples from hazardous waste incinerators, municipal waste combustors, and boilers and industrial furnaces. The collected samples are analyzed using EPA Method 9057. Method 0051 is designed to collect HCl and Cl₂ in their gaseous forms; sources such as those controlled by wet scrubbers that emit acid particulate matter (e.g., HCl dissolved in water droplets) must be sampled using an isokinetic HCl/Cl₂ sampling train (EPA Method 0050).

2.0 SUMMARY OF METHOD

An integrated gas sample is extracted from the stack and passes through a particulate filter, acidified water, and finally through an alkaline solution. The filter removes particulate matter, such as chloride salts, that could potentially react and form analyte in the absorbing solutions. In the acidified water absorbing solution, the HCl gas is solubilized and forms chloride ions. The Cl₂ gas present in the emissions has a very low solubility in acidified water and passes through to the alkaline absorbing solution where it undergoes hydrolysis to form a proton (H⁺), chloride ion, and hypochlorous acid

(HClO). The chloride ions in the separate solutions are measured by ion chromatography (EPA Method 9057).

3.0 INTERFERENCES

Volatile materials that produce chloride ions upon dissolution during sampling are obvious interferences in the measurement of HCl. One interferent for HCl is Cl₂, which disproportionates to HCl and HClO upon dissolution in water. The Cl₂ gas exhibits a very low solubility in water, however, and the use of acidic rather than neutral or basic solutions for collection of HCl greatly reduces the dissolution of any Cl₂ present. Sampling a 400 ppm HCl gas stream containing 50 ppm Cl₂ with this method does not cause a significant bias. Sampling a 220 ppm HCl gas stream containing 180 ppm Cl₂ results in a positive bias of 3.4 percent in the HCl measurement.

Reducing agents such as SO₂ may cause a positive bias in the Cl₂ measurement by the following reaction:



4.0 METHOD TARGET COMPOUNDS

chlorine
hydrogen chloride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

chlorine
hydrogen chloride

EPA METHOD 5040

Analysis of Sorbent Cartridges from Volatile Organic Sampling Train

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 5040 is used to analyze Tenax® and Tenax®/charcoal cartridges containing volatile principal organic hazardous constituents (POHCs) from wet stack gas effluents from hazardous waste incinerators. Volatile POHCs are defined as those POHCs with boiling points less than 100°C. Method 5040 is based on the quantitative thermal desorption of volatile POHCs from the Tenax® and Tenax®/charcoal traps and analysis by purge-and-trap gas chromatography/mass spectrometry (GC/MS).

2.0 SUMMARY OF METHOD

POHCs are collected on Tenax® and Tenax®/charcoal sorbent cartridges using a volatile organic sampling train (VOST), EPA Method 0030. The contents of the sorbent cartridges are spiked with an internal standard and thermally desorbed for 10 minutes at 180°C with organic-free nitrogen or helium gas (at a flow rate of 40 mL/min), bubbled through 5 mL of organic-free water, and trapped on an analytical adsorbent trap. After the 10 minute desorption, the analytical adsorbent trap is rapidly heated to 180°C, with the carrier gas flow reversed so that the effluent flow from the analytical trap is directed into the GC/MS. The volatile POHCs are separated by temperature-programmed gas

chromatography and detected by low resolution mass spectrometry. The concentrations of the volatile POHCs are calculated using the internal standard technique.

EPA Method 5030 and 8240 may be referenced for specific requirements for the thermal desorption unit, purge-and-trap unit, and GC/MS system.

3.0 INTERFERENCES

Interferences from hydrocarbons may be a problem if a source with significant hydrocarbon content is sampled. The mass of low molecular weight POHCs (such as acetonitrile, with a mass of 41) would coincide with the mass of ions common to all hydrocarbons, and acetonitrile would thus not be identifiable by low resolution mass spectrometric techniques.

4.0 METHOD TARGET COMPOUNDS

Volatile POHCs.

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

- acetonitrile*
- acrylonitrile*
- allyl chloride
- benzene
- bis(chloromethyl) ether*
- carbon disulfide
- carbon tetrachloride
- chlorobenzene**
- chloroform

chloromethyl methyl ether^{*}
chloroprene
1,1-dimethylhydrazine^{*}
1,4-dioxane^{*}
1,2-epoxybutane^{*}
ethyl acrylate^{*}
ethylbenzene^{**}
ethyl chloride^{***}
ethylene dibromide
ethylene dichloride
ethylene imine^{*}
ethylidene dichloride
hexane
methyl bromide^{***}
methyl chloride^{***}
methyl chloroform
methyl ethyl ketone^{*}
methyl hydrazine^{*}
methyl iodide
methyl isobutyl ketone^{***}
methyl isocyanate^{*}
methyl methacrylate^{*}
methyl tert-butyl ether^{*}
methylene chloride
propylene oxide^{*}
1,2-propylene imine^{*}
tetrachloroethylene^{**}
toluene^{**}
1,1,2-trichloroethane^{**}

trichloroethylene
triethylamine^{*}
2,2,4-trimethylpentane
vinyl acetate^{*}
vinyl bromide^{***}
vinyl chloride^{***}
vinylidene chloride

- ^{*} A protocol has been developed for sample analysis for water-soluble volatile POHCs and PICs (EPA-600/8-87-008). Application of this protocol may improve recoveries for polar water-soluble compounds.
- ^{**} Boiling point above 100°C.
- ^{***} Boiling point below 30°C. Special care must be taken to avoid breakthrough on sorbent.

EPA DRAFT METHOD 5041

Protocol for the Analysis of Sorbent Cartridges from Volatile Organic Sampling Train (VOST): Wide-Bore Capillary Column Technique

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 5041 is used to analyze Volatile Principal Organic Hazardous Constituents (POHCs) collected from the stack gas effluents of hazardous waste incinerators using the VOST methodology which uses EPA Method 0030 for sampling. Draft Method 5041 is most successfully applied to the analysis of non-polar organic compounds that vaporize between 30°C and 100°C. Data are applied to the calculation of destruction and removal efficiency (DRE).

The VOST methodology may also be used to collect and analyze many compounds that boil above 100°C. However, sampling method collection efficiency, sampling tube desorption efficiency, and analytical method precision and bias should be determined for these compounds. An organic compound with boiling point below 30°C may break through the sorbent under the conditions used for sample collection. The quantitative value obtained for such a compound must be qualified, since the value represents a minimum value for the compound if breakthrough has occurred.

The VOST analytical methodology can be used to quantify volatile organic compounds (VOCs) that are insoluble or slightly soluble in water. When volatile water-soluble compounds are included in the VOST organic compound analyte list,

quantitation limits can be expected to be approximately ten times higher than quantitation limits for water-insoluble compounds (if the compounds can be recovered at all) because the purging efficiency from water (and possibly also from Tenax®) is so poor. Purging efficiency from water can be improved by modifying the VOST analytical methodology to include addition of salt (sodium chloride or sodium sulfate) to the purge water and heating the purge water (see EPA-600/8-87-008).

Overall sensitivity for the method depends on the level of analytical interferences encountered in the sample and the presence of detectable levels of volatile POHCs in the blanks. The target detection limit for the method is $0.1 \mu\text{g}/\text{m}^3$ (ng/L) of flue gas, to permit calculation of a DRE equal to or greater than 99.99 percent for volatile POHCs that may be present in the waste stream at 100 ppm. The upper end of the range of applicability of this method is limited by the dynamic range of the analytical instrumentation, the overall loading of organic compounds on the exposed tubes, and breakthrough of the volatile POHCs on the sorbent traps used to collect the sample.

2.0 SUMMARY OF METHOD

Sorbent tubes are thermally desorbed by heating and purging with organic-free helium. The gaseous effluent from the tubes is bubbled through pre-purged organic-free water and trapped on an analytical sorbent trap in a purge-and-trap unit. After desorption, the analytical sorbent trap is heated rapidly and the gas flow from the analytical trap is directed to the head of a wide-bore column under subambient conditions. The VOCs desorbed from the analytical trap are separated by temperature-programmed high resolution gas chromatography and detected by continuously-scanning low resolution mass spectrometry. Concentrations of VOCs are calculated from a multi-point calibration curve, using the method of response factors.

3.0 INTERFERENCES

Sorbent tubes that are to be analyzed for VOCs can be contaminated by diffusion of VOCs (particularly Freon® refrigerants and common organic solvents) through the external container (even through a Teflon®-lined screw cap on a glass container) and the Swagelok® sorbent tube caps during shipment and storage. The sorbent tubes can also be contaminated if organic solvents are present in the analytical laboratory. The use of blanks is essential to assess the extent of any contamination. Field blanks must be prepared and taken to the field. The end caps of the tubes are removed for the period of time required to exchange two pairs of traps on the VOST sampling apparatus. The tubes are recapped and shipped and handled exactly as the actual field samples are shipped and handled. At least one pair of field blanks is included with each six pairs of sample cartridges collected.

At least one pair of blank cartridges (one Tenax®, one Tenax®-charcoal) must be included with shipment of cartridges to a hazardous waste incinerator site as trip blanks. These trip blanks will be treated like field blanks except that the end caps will not be removed during storage at the site. This pair of traps will be analyzed to monitor potential contamination that may occur during storage and shipment.

Analytical system blanks are required to demonstrate that contamination of the purge-and-trap unit and the gas chromatograph/mass spectrometer has not occurred or that, in the event of analysis of sorbent tubes with very high levels of organic compounds, no compound carryover is occurring. Tenax® from the same preparation batch as the Tenax® used for field sampling should be used in the preparation of the method (laboratory) blanks. A sufficient number of cleaned Tenax® tubes from the same batch as the field samples should be reserved in the laboratory for use as blanks.

Cross-contamination can occur whenever low-level samples are analyzed after high-level samples, or when several high-level samples are analyzed sequentially. When an unusually concentrated sample is analyzed, this analysis should be followed by a method blank to establish that the analytical system is free of contamination. If analysis of a blank demonstrates that the system is contaminated, an additional bake cycle should be used. If the analytical system is still contaminated after additional baking, routine system maintenance should be performed: the analytical trap should be changed and conditioned, routine column maintenance should be performed (or replacement of the column and conditioning of the new column, if necessary), and bakeout of the ion source (or cleaning of the ion source and rods, if required). After system maintenance has been performed, analysis of a blank is required to demonstrate that the cleanliness of the system is acceptable.

If the emission source has a high level of non-target organic compounds (for example, hydrocarbons at levels of hundreds of ppm), the presence of these non-target compounds will interfere with the performance of the VOST analytical methodology. If one or more of the compounds of interest saturates the chromatographic and mass spectrometric instrumentation, no quantitative calculations can be made and the tubes that have been sampled under the same conditions will yield no valid data for any of the saturated compounds and may not yield valid data for other compounds. In the presence of a very high organic loading, even if the compounds of interest are not saturated, the instrumentation is so saturated that the linear range has been surpassed. When instrument saturation occurs, it is possible that compounds of interest cannot even be identified correctly because a saturated mass spectrometer may mis-assign masses. Even if compounds of interest can be identified, accurate quantitative calculations are impossible at detector saturation. No determination can be made at or beyond detector saturation, even if the target compound itself is not saturated. At detector saturation, a negative bias will be encountered in analytical measurements and no accurate calculation can be made for the DRE if analytical values may be biased negatively.

Compounds that coelute chromatographically with the compounds of interest may interfere with the analysis if the coeluting compounds have ions at the same masses as the compound of interest. An alternate ion can be selected for the compound of interest (provided that detector saturation has not occurred) to avoid the interference at the primary quantitation mass.

4.0 METHOD TARGET COMPOUNDS

- acetone
- acrylonitrile
- benzene
- bromodichloromethane
- bromoform
- bromomethane
- carbon disulfide
- carbon tetrachloride
- chlorobenzene
- chlorodibromomethane
- chloroethane
- chloroform
- chloromethane
- dibromomethane
- 1,1-dichloroethane
- 1,2-dichloroethane
- 1,1-dichloroethene
- trans-1,2-dichloroethene
- 1,2-dichloropropane
- cis-1,3-dichloropropene
- trans-1,3-dichloropropene

ethylbenzene
iodomethane
methylene chloride
styrene
1,1,2,2-tetrachloroethane
tetrachloroethene
toluene
1,1,1-trichloroethane
1,1,2-trichloroethane
trichloroethene
trichlorofluoromethane
1,2,3-trichloropropane
vinyl chloride
xylenes

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetonitrile (requires modification of the methodology for water-soluble compounds, but may require high resolution mass spectrometry)

acrylonitrile

allyl chloride

benzene

bis(chloromethyl) ether (will require modification of the methodology for water-soluble compounds)

bromoform

carbon disulfide

carbon tetrachloride

chlorobenzene (above 100°C boiling point)

chloroform
chloromethyl methyl ether (water-soluble)
chloroprene
1,1-dimethylhydrazine (water-soluble)
1,4-dioxane (water-soluble)
ethyl acrylate (water-soluble)
ethylbenzene (above 100°C boiling point)
ethyl chloride (low boiling point; requires special care)
ethylene dibromide (above 100°C boiling point)
ethylene dichloride
ethylene imine (water-soluble)
ethylidene dichloride
hexane
methyl bromide (low boiling point; requires special care)
methyl chloride (low boiling point; requires special care)
methyl chloroform
methyl ethyl ketone (water-soluble)
methyl hydrazine (water-soluble)
methyl iodide
methyl isobutyl ketone (above 100°C boiling point; water-soluble)
methyl isocyanate (water-soluble)
methyl methacrylate (water-soluble)
methyl tert-butyl ether (water-soluble)
methylene chloride
propylene dichloride
propylene oxide (water-soluble)
1,2-propylene imine (water-soluble)
styrene (above 100°C boiling point)
1,1,2,2-tetrachloroethane (above 100°C boiling point)

tetrachloroethylene (above 100°C boiling point)
toluene (above 100°C boiling point)
1,1,2-trichloroethane (above 100°C boiling point)
trichloroethylene
triethylamine (water-soluble)
2,2,4-trimethylpentane
vinyl acetate (water-soluble)
vinyl bromide (low boiling point; requires special care)
vinyl chloride (low boiling point; requires special care)
vinylidene chloride
xylenes (above 100°C boiling point)

EPA METHOD 8080

Organochlorine Pesticides and PCBs

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 8080 is used to determine the concentration of various organochlorine pesticides and polychlorinated biphenyls (PCBs) in soil at levels of parts-per-billion. The method can be modified in order to analyze air samples. Method 8080 should be used only for non-stack stationary sources.

2.0 SUMMARY OF METHOD

Prior to analysis, appropriate sample extraction techniques must be used. Water samples are extracted with methylene chloride using either EPA Method 3510 or EPA Method 3520. Solid samples are extracted using EPA Method 3540 or EPA Method 3550. The extraction solvent must be exchanged to hexane. A modification to accommodate air samples may be necessary. Once sample preparation is completed, the sample is injected, either manually or by an autosampler, into a gas chromatograph (GC). The compounds in the GC effluent are detected by an electron capture detector or a halogen-specific detector. The identification and concentration of the target compounds are based on a comparison of the retention times and peak areas of calibration standards with the sample peaks. A minimum of five concentration levels is required for calibration.

Method 8080 recognizes an Aroclor profile rather than individual PCBs. Since Aroclors are made up of numerous PCBs, their chromatograms are multi-peak and identification of an Aroclor is by pattern recognition. Method 8080 should not be applied to stack samples because Aroclors that have been combusted no longer exhibit the pattern of an Aroclor and consequently will not be identified. Spiking each sample, standard, and blank with the surrogates dibutyl chlorendate and/or 2,4,5,6-tetrachloro-meta-xylene is recommended in order to monitor the performance of the extraction, cleanup (when used), and analytical system.

3.0 INTERFERENCES

DDT and endrin degrade easily in the injection port of the GC as a result of buildup of high-boiling residue from sample injection. The degradation products of these compounds can interfere with peak detection and identification of certain compounds. Therefore, proper GC maintenance procedures are recommended in order to avoid these problems.

4.0 METHOD TARGET COMPOUNDS

- aldrin
- alpha-BHC
- beta-BHC
- delta-BHC
- lindane
- chlordan
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- dieldrin

endosulfan I
endosulfan II
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
methoxychlor
toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

polychlorinated biphenyls
4,4'-DDE
heptachlor
lindane
methoxychlor
toxaphene
chlordan

EPA METHOD 8270

Gas Chromatography/Mass Spectrometry for Semivolatile Organics: Capillary Column Technique

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 8270 is used to determine the concentration of semivolatile organic compounds in extracts prepared from all types of solid waste matrices, soils, and ground water. It is also applicable to an extract from sorbent media in conjunction with Method 0010. Direct injection of a sample may be used in limited applications.

Method 8270 can be used to quantify most neutral, acidic, and basic organic compounds that are soluble in methylene chloride and capable of being eluted without derivatization as sharp peaks from a gas chromatographic fused-silica capillary column coated with a slightly polar silicone. Such compounds include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons and pesticides, phthalate esters, organophosphate esters, nitrosamines, haloethers, aldehydes, ethers, ketones, anilines, pyridines, quinolines, aromatic nitro compounds, and phenols, including nitrophenols.

The following compounds may require special treatment when being determined by this method:

- Benzidine can be subject to oxidative losses during solvent concentration. Also, chromatography is poor.
- Alpha-BHC, gamma-BHC, endosulfan I and II, and endrin are subject to decomposition under the alkaline conditions of the extraction step. Neutral extraction should be performed if these compounds are expected.
- Hexachlorocyclopentadiene is subject to thermal decomposition in the inlet of the gas chromatograph, chemical reaction in acetone solution, and photochemical decomposition.
- N-Nitrosodimethylamine is difficult to separate from the solvent under the chromatographic conditions described.
- N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine.
- Pentachlorophenol, 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, benzoic acid, 2-nitroaniline, 3-nitroaniline, 4-chloroaniline, and benzyl alcohol are subject to erratic chromatographic behavior, especially if the gas chromatographic system is contaminated with high-boiling material. Derivatization can help to stabilize the chromatographic performance of these compounds.
- Acrylic acid will require derivatization to apply the analytical methodology.
- The phthalate esters exhibit better recoveries under acid extraction conditions.
- Bromoform, chlorobenzene, cumene, 1,3-dichloropropene, 1,4-dioxane, epichlorohydrin, ethylbenzene, ethylene dibromide, methyl isobutyl ketone, 2-nitropropane, styrene, 1,1,2,2-tetrachloroethane, tetrachloroethylene, toluene, 1,1,2-trichloroethane, and *o*-, *m*-, and *p*-xylene are within the boiling point range for Method 8270, but they are sufficiently volatile that care must be taken in sample concentration to avoid loss. An adjustment in chromatographic conditions will be required to resolve the relatively volatile compounds from the solvent.

- 4-Aminobiphenyl, aniline, *o*-anisidine, benzidine, 3,3'-dichlorobenzidine, N,N-diethylaniline, 3,3'-dimethoxybenzidine, dimethylaminoazobenzene, 3,3'-dimethylbenzidine, 4,4'-methylene bis (2-chloroaniline), 4,4'-methylenedianiline, *p*-phenylenediamine, quinoline, and 2,4-toluenediamine are basic nitrogen-containing compounds and careful control of pH during extraction is required to optimize recovery.

The practical quantitation limit for Method 8270 is approximately 50 µg/mL of extract. The entire sorbent module with filter is typically extracted and concentrated to 1 mL (a final volume of 5 mL is used to avoid loss of volatile compounds), and this final extract volume represents the entire volume of gas sampled.

2.0 SUMMARY OF METHOD

Method 8270 describes conditions for gas chromatography/mass spectrometry (GC/MS) to allow for the separation of the semivolatile compounds on the method target list. Sample extraction, purification, and concentration techniques are addressed in other methods. EPA Methods 3510, 3520, 3540, 3550, 3580 may be applicable to the sample preparation. The following purification methods may be used prior to GC/MS analysis:

phenols, Methods 3630, 3640, 8040
 phthalate esters, Method 3610, 3620, 3640
 nitrosamines, Method 3610, 3620, 3640
 organochlorine pesticides and PCBs, Method 3620, 3640, 3660
 polynuclear aromatic hydrocarbons, Method 3611, 3630, 3640
 nitroaromatics and cyclic ketones, Method 3620, 3640
 haloethers, Method 3620, 3640
 chlorinated hydrocarbons, Method 3620, 3640
 organophosphorus pesticides, Method 3620, 3640

petroleum waste, Method 3611, 3650

all priority pollutant base, neutral, and acids, Method 3640.

3.0 INTERFERENCES

Raw GC/MS data from all blanks, samples, and spikes must be evaluated for interferences. If an interference results from the preparation and/or cleanup of samples, corrective action can be taken to eliminate the problem. If the problem is a very high sample background of alkyl or aromatic hydrocarbons, very little can be done to resolve the problem other than dilution of the samples, which raises the detection limit. If chromatographic coelution occurs, deconvolution of the coeluting components by mass spectrometric techniques will be effective if the compounds are not chemically related and their mass spectra can be resolved. If isomers coelute and their mass spectra are similar, the coelution cannot be resolved.

Contamination by carryover can occur whenever high level and low level samples are analyzed sequentially. To reduce carryover, the sample syringe must be rinsed carefully with solvent between sample injections. The chromatographic column should be allowed to remain at a high temperature until all late-eluting components have eluted from the column in order to avoid chromatographic carryover problems. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of clean solvent to check for cross-contamination. If contamination is observed, the injections of solvent should be repeated until the contamination is no longer observed before another sample injection is performed.

4.0 METHOD TARGET COMPOUNDS

acenaphthene

acenaphthylene

acetophenone
aldrin
aniline
anthracene
4-aminobiphenyl
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260
benzidine
benzoic acid
benzo(a)anthracene
benzo(b)fluoranthene
benzo(k)fluoranthene
benzo(g,h,i)perylene
benzo(a)pyrene
benzyl alcohol
alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (lindane)
bis(2-chloroethoxy)methane
bis(2-chloroethyl)ether
bis(2-chloroisopropyl)ether
bis(2-ethylhexyl) phthalate
4-bromophenyl phenyl ether

butyl benzyl phthalate
chlordane
4-chloroaniline
1-chloronaphthalene
2-chloronaphthalene
4-chloro-3-methylphenol
chrysene
4,4'-DDD
4,4'-DDE
4,4'-DDT
dibenz(a,j)acridine
dibenz(a,h)anthracene
di-n-butyl phthalate
1,3-dichlorobenzene
1,4-dichlorobenzene
1,2-dichlorobenzene
3,3'-dichlorobenzidine
dichloroethyl ether
2,4-dichlorophenol
2,6-dichlorophenol
dieldrin
diethyl phthalate
p-dimethylaminoazobenzene
7,12-dimethylbenz(a)anthracene
alpha-, alpha-dimethylphenethylamine
2,4-dimethylphenol
dimethyl phthalate
4,6-dinitro-2-methylphenol
2,4-dinitrophenol

2,4-dinitrotoluene
2,6-dinitrotoluene
diphenylamine
1,2-diphenylhydrazine
di-n-octyl phthalate
endosulfan I
endosulfan II
endosulfan sulfate
endrin
endrin aldehyde
endrin ketone
ethyl methanesulfonate
fluoranthene
fluorene
heptachlor
heptachlor epoxide
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
indeno(1,2,3-cd)pyrene
isophorone
methoxychlor
3-methylcholanthrene
methyl methanesulfonate
2-methylnaphthalene
2-methylphenol
4-methylphenol
naphthalene

1-naphthylamine
2-naphthylamine
3-nitroaniline
4-nitroaniline
nitrobenzene
2-nitrophenol
4-nitrophenol
N-nitrosodi-n-butylamine
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodipropylamine
N-nitrosopiperidine
pentachlorobenzene
pentachloronitrobenzene
pentachlorophenol
phenacetin
phenanthrene
phenol
2-picoline
pronamide
pyrene
1,2,4,5-tetrachlorobenzene
2,3,4,6-tetrachlorophenol
1,2,4-trichlorobenzene
2,4,5-trichlorophenol
2,4,6-trichlorophenol
toxaphene

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetamide
acetophenone (8270 target)
2-acetylaminofluorene
acrylamide
acrylic acid
4-aminobiphenyl (8270 target)
aniline (8270 target)
o-anisidine
benzidine (8270 target)
benzotrichloride
benzyl chloride
biphenyl
bis(2-ethylhexyl) phthalate (8270 target)
bromoform
catechol
chlordan (8270 target)
chloroacetic acid
2-chloroacetophenone
chlorobenzene
chlorobenzilate
o-cresol (8270 target)
m-cresol
p-cresol (8270 target)
cresylic acid (mixture of cresols)
cumene
2,4-D
DDE (8270 target)

1,2-dibromo-3-chloropropane
dibutyl phthalate (8270 target)
1,4-dichlorobenzene (8270 target)
3,3'-dichlorobenzidine (8270 target)
1,3-dichloropropene
dichlorvos
diethanolamine
N,N-diethylaniline
diethyl sulfate
3,3'-dimethoxybenzidine
dimethylaminoazobenzene (8270 target)
3,3'-dimethylbenzidine
dimethyl formamide
dimethyl phthalate (8270 target)
dimethyl sulfate
4,6-dinitro-*o*-cresol (8270 target)
2,4-dinitrophenol (8270 target)
2,4-dinitrotoluene (8270 target)
1,4-dioxane
1,2-diphenylhydrazine (8270 target)
epichlorohydrin
ethylbenzene
ethylene dibromide
ethylene glycol
glycol ethers
heptachlor (8270 target)
hexachlorobenzene (8270 target)
hexachlorobutadiene (8270 target)
hexachlorocyclopentadiene (8270 target)

hexachloroethane (8270 target)
hexamethylene-1,6-diisocyanate
hydroquinone
isophorone (8270 target)
lindane (8270 target)
maleic anhydride
methoxychlor (8270 target)
4,4'-methylene bis(2-chloroaniline)
methylene diphenyl diisocyanate
4,4'-methylenedianiline
naphthalene (8270 target)
nitrobenzene (8270 target)
4-nitrobiphenyl
4-nitrophenol (8270 target)
N-nitroso-N-methylurea
N-nitrosodimethylamine (8270 target)
N-nitrosomorpholine
parathion
pentachloronitrobenzene (8270 target)
pentachlorophenol (8270 target)
phenol (8270 target)
p-phenylenediamine
phthalic anhydride
polychlorinated biphenyls
polycyclic organic matter
1,3-propane sultone
beta-propiolactone
quinoline
quinone

styrene
styrene oxide
1,1,2,2-tetrachloroethane
tetrachloroethylene
toluene
2,4-toluenediamine
2,4-toluene diisocyanate
o-toluidine
toxaphene (8270 target)
1,2,4-trichlorobenzene (8270 target)
1,1,2-trichloroethane
2,4,5-trichlorophenol (8270 target)
2,4,6-trichlorophenol (8270 target)
trifluralin
xylenes: o-xylene, m-xylene, p-xylene

EPA METHOD 8280

The Analysis of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 8280 is used to determinate tetra-, penta-, hexa-, hepta-, and octachlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) in chemical wastes, including still bottoms, fuel oils, sludges, fly ash, reactor residues, soil, and water.

2.0 SUMMARY OF METHOD

This procedure uses a matrix-specific extraction, analyte-specific cleanup, and high resolution capillary column gas chromatography/low resolution mass spectrometry techniques. An analytical system with a temperature-programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases is needed. Fused silica capillary columns are required, and one of the following is recommended: (1) 50 m CP-Sil-88; (2) DB-5, 30 m x 0.25 mm ID, 0.25 μ m film thickness; or (3) 30 m SP-2250. However, any capillary column that provides separation of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) from all other TCDD's with higher isomers may be used.

Two types of calibration procedures are required: An initial calibration is required before any samples are analyzed, and routine calibration conducted

intermittently throughout the sample analyses. The routine calibration consists of analyzing the column performance check solution and a mid-range concentration calibration solution.

Samples are analyzed with Selected Ion Monitoring mass spectrometry techniques. Strict identification criteria for PCDDs and PCDFs are listed in the method. The concentration of individual isomers is determined using relative response factors that were calibrated using data obtained from the analysis of multi-level calibration standards.

Because of the extreme toxicity of many of the compounds listed as analytes, the analyst must take the necessary precautions to prevent exposure to materials known or believed to contain PCDDs or PCDFs. Laboratory personnel must ensure that safe handling procedures are employed.

3.0 INTERFERENCES

The sensitivity of this method depends on the level of interferents within a given matrix. Interferents coextracted from the sample will vary considerably from source to source, depending upon the industrial process being sampled. PCDDs and PCDFs are often associated with other interfering chlorinated compounds such as PCBs and polychlorinated diphenyl ethers, which may be found at higher concentrations than that of the analytes of interest.

4.0 METHOD TARGET COMPOUNDS

tetrachlorodibenzo-p-dioxin
tetrachlorodibenzofuran
pentachlorodibenzo-p-dioxin

pentachlorodibenzofuran
hexachlorodibenzofuran
hexachlorodibenzo-p-dioxin
heptachlorodibenzo-p-dioxin
heptachlorodibenzofuran
octachlorodibenzofuran
octachlorodibenzo-p-dioxin

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

dibenzofurans
2,3,7,8-tetrachlorodibenzo-p-dioxin.

EPA DRAFT METHOD 8290

Analytical Procedures and Quality Assurance for Multimedia Analysis of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 8290 provides for the detection and quantitative measurement of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), polychlorinated dibenzo-p-dioxins (PCDDs; tetra- through octachlorinated homologs), and polychlorinated dibenzofurans (PCDFs; tetra-through octachlorinated homologs) in a variety of environmental matrices and at part-per-trillion (ppt) concentrations. This method has been applied to samples from the following matrices: soil, sediment, fly ash, water, sludges, fuel oil, still bottoms, fish tissue, paper pulp, human adipose tissue, and gaseous and particulate emissions.

Because of the extreme toxicity of many of the compounds listed as analytes, the analyst must take the necessary precautions to prevent exposure to materials known or believed to contain PCDDs or PCDFs. Laboratory personnel must ensure that safe handling procedures are employed.

2.0 SUMMARY OF METHOD

This procedure uses matrix-specific extraction, analyte-specific clean-up, and high resolution capillary gas chromatography/high resolution mass spectrometry (HRGC/HRMS) techniques. A specified amount of matrix (or the entire sorbent sampling trap plus filter from a sampling train for gaseous emissions) is spiked with a solution containing specified amounts of the nine isotopically-labeled ($^{13}\text{C}_{12}$) PCDDs/PCDFs. The sample is then extracted according to a matrix-specific extraction procedure. The extracts are submitted to an acid/base washing treatment and dried. Following a solvent exchange, the residue is purified by column chromatography on neutral alumina and carbon on Celite 545®. Preparation of the final extract for HRGC/HRMS analysis is accomplished by adding a solution containing the isotopically-labeled recovery standards to the concentrated carbon column eluate. The recovery standard is used to determine the percent recoveries of isotopically-labeled standards spiked at the beginning of the extraction process. An aliquot of the concentrated extract is injected into a HRGC/HRMS system capable of performing selected ion monitoring at resolving powers of at least 10,000 (10 percent valley definition).

Compound identification for the compounds for which an isotopically-labeled standard is used is based upon elution at the exact retention time established by analysis of standards and simultaneous detection of the two most abundant ions in the molecular ion region. Compounds for which no isotopically-labeled standard is available are identified by their relative retention times, which must fall within the established retention windows, and the simultaneous detection of the two most abundant ions in the molecular ion region. The retention windows are established by analysis of a GC Performance Evaluation solution. Identification is confirmed by comparing the ratio of the integrated ion abundance of the molecular ion species to the theoretical abundance ratio.

Quantification of the individual congeners, total PCDDs and PCDFs, is based upon a multipoint (seven points) calibration curve for each homolog, with each calibration solution being analyzed once.

3.0 INTERFERENCES

Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts or elevated baselines that may cause misinterpretation of the chromatographic data. All of these materials must be demonstrated to be free from interferences under the conditions of the laboratory analysis by analyzing laboratory method blanks. Analysts should avoid using polyvinyl chloride gloves. High-purity reagents and solvents help minimize interference problems. Purifying solvents by distillation in all-glass systems may be necessary.

The sensitivity of the method is dependent upon the level of interferences within a given matrix. Interferences co-extracted from the sample matrix will vary considerably from matrix to matrix. PCDDs and PCDFs are often associated with other interfering chlorinated substances such as polychlorinated biphenyls (PCBs), polychlorinated diphenyl ethers (PCDPEs), polychlorinated naphthalenes, and polychlorinated xanthenes which may be found at concentrations several orders of magnitude higher than the analytes of interest. Retention times of target analytes must be verified using reference standards, and these values must correspond to the established retention time windows. While certain purification techniques are included as part of this method, unique samples may require other additional purification steps to achieve lower detection limits.

4.0 METHOD TARGET COMPOUNDS

polychlorinated dibenzo-p-dioxins
polychlorinated dibenzofurans
2,3,7,8-tetrachlorodibenzo-p-dioxin

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

dibenzofurans
2,3,7,8-tetrachlorodibenzo-p-dioxin

EPA METHOD 8310

Polynuclear Aromatic Hydrocarbons

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 8310 is used to determine the concentration of certain polynuclear aromatic hydrocarbons (PAH) in ground water and wastes at parts-per-billion levels. By extension, the methodology should be applicable to material extracted from a solid sorbent module of a sampling train from EPA Method 0010, which is used to sample gaseous emissions from a stationary source.

Extension of the methodology to PAH containing functional groups should be possible, depending upon the ability to adjust analytical conditions and the availability of standards for the compounds of interest.

Use of Method 8310 presupposes a high expectation of finding the specific compounds of interest. To screen samples for any or all of the method target compounds (see listed below), independent protocols for the verification of identity must be developed. One method that can be used to certify identity is gas chromatography/mass spectrometry (GC/MS).

Method detection limits are compound-dependent, ranging from 0.4 $\mu\text{g/L}$ for indeno(1,2,3-cd)pyrene in ground water to 230,000 $\mu\text{g/L}$ for acenaphthylene in non-water

miscible waste. Detection limits for PAH in gaseous emissions have not been determined directly. This methodology has not been directly and specifically applied to the determination of polycyclic organic matter other than the PAH specifically listed in the methodology. A quantitative analysis of other PAH and functionalized PAH will require adjustment of analytical conditions and the use of appropriate standards. An additional method such as GC/MS, if applicable, may be required to identify additional compounds.

If coelution of compounds is encountered in samples taken from gaseous emissions of stationary sources, Method 8310 may not be applicable unless analytical conditions can be adjusted to achieve chromatographic resolution.

2.0 SUMMARY OF METHOD

Prior to using Method 8310, appropriate sample extraction methods must be used. A 5- to 25 μ L aliquot of extract is injected into a high performance liquid chromatograph (HPLC), and compounds in the effluent are detected by ultraviolet (uv) and fluorescence detectors. If interferences prevent proper detection of the analytes of interest, the method may also be performed on extracts that have undergone purification using silica gel column cleanup (EPA Method 3630).

3.0 INTERFERENCES

The sensitivity of the method usually depends on the level of interferences rather than instrumental limitations. The limits of detection above for the liquid chromatographic approach represent sensitivities that can be achieved in the absence of interferences. When interferences are present, the level of sensitivity will be lower, if analysis is possible at all.

Solvents, reagents, glassware, and other sample processing hardware may yield discrete artifacts and/or elevated baselines, causing misinterpretation of the chromatograms. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be required.

Interferences coextracted from the samples will vary considerably from source to source. Although a general cleanup technique is provided as part of Method 8310, individual samples may require additional cleanup approaches to achieve the desired sensitivity.

The chromatographic conditions described in Method 8310 allow for a unique resolution of the specific PAH compounds covered by this method. Other PAH compounds, in addition to matrix artifacts, may interfere.

4.0 METHOD TARGET COMPOUNDS

acenaphthene
acenaphthylene
anthracene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(ghi)perylene
benzo(k)fluoranthene
chrysene
dibenzo(a,h)anthracene
fluoranthene

fluorene
indeno(1,2,3-cd)pyrene
naphthalene
phenanthrene
pyrene

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

naphthalene*
4-aminobiphenyl
benzidine
biphenyl
chlorobenzilate
3,3'-4 dichlorobenzidine
3,3'-dimethoxybenzidine
dimethylaminoazobenzene
3,3'-dimethylbenzidine
4,4'-methylene bis(chloroaniline)
methylene diphenyl isocyanate
4,4'-methylenedianiline
4-nitrobiphenyl
p-phenylenediamine
2,4-toluenediamine
2,4-toluene diisocyanate
o-toluidine
polycyclic organic matter

* Method 8310 is directly applicable only to this compound.

EPA DRAFT METHOD 8315

Determination of Formaldehyde by DNPH Derivatization, Solid Sorbent Extraction, and HPLC Detection

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 8315 uses high performance liquid chromatography (HPLC) to determinate formaldehyde in liquid environmental matrices and leachates of solid samples applicable to the determination of formaldehyde and acetaldehyde. Extension of the methodology to HPLC determination of formaldehyde and acetaldehyde in gaseous emission samples is feasible, and the methodology can also be applied to other aldehydes and ketones. When this method is used to analyze unfamiliar sample matrices, compound identification should be supported by at least one additional qualitative technique such as gas chromatography/mass spectrometry.

Actual detection limits are compound- and matrix-dependent. However, for a list of aldehydes and ketones tested, detection limits were approximately 2 ppbv when reagent capacity (for sampling by EPA Draft Method 0011) was 60-100 ppm.

2.0 SUMMARY OF METHOD

In Draft Method 0011, the 2,4-dinitrophenylhydrazine (DNPH) derivative of aldehydes in the emission stream is formed during sampling, since the emissions are bubbled through impingers containing an aqueous acidic solution of DNPH. This

solution is returned to the laboratory and extracted with methylene chloride. The methylene chloride extract is concentrated to less than 10 mL using the Kuderna-Danish procedure. Liquid chromatographic conditions described in Draft Method 8315 which permit the separation and measurement of formaldehyde (and other aldehydes and ketones) in the extract by absorbance detection at 360 nm.

3.0 INTERFERENCES

Analysis for formaldehyde is especially complicated by its ubiquitous occurrence in the environment. The volatile aldehydes, such as formaldehyde and acetaldehyde, may be contaminants in volatile organic solvents. Since formaldehyde is widely used in building insulation, great care is required to determine whether the laboratory atmosphere is contaminated with formaldehyde. Blanks and controls that are treated under the same laboratory conditions as samples are of crucial importance in assessing background levels of aldehydes. Solvent blanks for each lot of solvents used in sample preparation are important. Glassware must not be rinsed with acetone in the cleaning process.

Matrix interferences will result from contaminants that are coextracted from the sample, and will vary from source to source. Since the analytical methodology is HPLC, quantitative analysis of compounds of interest depends on the absence of coeluting interferences.

4.0 METHOD TARGET COMPOUNDS

acetaldehyde^{*}
acetone/propionaldehyde
acrolein
benzaldehyde

butyraldehyde
dimethylbenzaldehyde
formaldehyde*
hexaldehyde
isovalderaldehyde
methyl ethyl ketone
o-, m-, and p-tolualdehyde
valeraldehyde

- * The target compounds actually cited in Draft Method 8315 are formaldehyde and acetaldehyde. The other listed compounds have been determined by DNPH derivatization followed by HPLC analysis.

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetophenone
acrolein
2-chloroacetophenone
formaldehyde
isophorone
methyl ethyl ketone
methyl isobutyl ketone
propionaldehyde
quinone

EPA DRAFT METHOD 8318

N-Methyl Carbamates by High Performance Liquid Chromatography (HPLC)

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U. S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Draft Method 8318 is used to determine the concentration of N-methylcarbamates in soil, water, and waste matrices. Extension of the methodology is required to allow preparation and analysis of samples from stationary sources.

2.0 SUMMARY OF METHOD

N-Methylcarbamates are extracted from aqueous samples with methylene chloride, and from soils, oily solid waste, and oils with acetonitrile. The extract solvent is exchanged to methanol/ethylene glycol, and then the extract is cleaned up on a C-18 cartridge, filtered, and eluted on a C-18 analytical column. After separation, the target analytes are hydrolyzed and derivatized post-column, then quantified fluorimetrically.

Due to the specific nature of this analysis, confirmation by a secondary method is not essential. However, fluorescence due to post-column derivatization may be confirmed by substituting the NaOH and o-phthalaldehyde solutions with deionized water and reanalyzing the sample. If fluorescence is detected, then a positive interference is present and care should be taken in the interpretation of the results.

The sensitivity of the method usually depends upon the level of interferences present, rather than on the instrumental conditions. Waste samples with a high level of extractable fluorescent compounds are expected to yield significantly higher detection limits.

3.0 INTERFERENCES

Fluorescent compounds, primarily alkyl amines and compounds that yield primary alkyl amines on base hydrolysis, are potential sources of interferences. Coeluting compounds that are fluorescence quenchers may result in negative interferences. Impurities in solvents and reagents are additional sources of interferences. Before processing any samples, the analyst must demonstrate daily, through the analysis of solvent blanks, that the entire analytical system is interference-free.

4.0 METHOD TARGET COMPOUNDS

- aldicarb (Temik)
- aldicarb sulfone
- carbaryl (Sevin)
- carbofuran (Furadan)
- dioxacarb
- 3-hydroxycarbofuran
- methiocarb (Mesuro)
- methomyl (Lannate)
- promecarb
- propoxur (Baygon).

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

carbaryl

propoxur

ethyl carbamate

EPA METHOD 9057

Analysis of Samples from HCl/Cl₂ Emission Sampling

REFERENCE:

Test Methods for Evaluating Solid Waste, Third Edition. Report No. SW-846. U. S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, DC: 1986.

1.0 SCOPE AND APPLICATION

EPA Method 9057 is used to determine hydrogen chloride (HCl) and chlorine (Cl₂) in stack gas emission samples collected from hazardous waste and municipal waste incinerators using the midget impinger HCl/Cl₂ sampling train (Method 0051) or the isokinetic HCl/Cl₂ sampling train (Method 0050).

The lower detection limit is 0.1 µg of chloride ions per mL of sample solution. Samples with concentrations that exceed the linear range of the analytical instrumentation may be diluted.

Method 9057 is recommended for use only by analysts experienced in the use of ion chromatography and in the interpretation of ion chromatograms.

2.0 SUMMARY OF METHOD

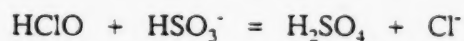
The stoichiometry of HCl and Cl₂ collection in the sampling train (Methods 0050 and 0051) is as follows: in the acidified water absorbin solution, the HCl gas is solubilized and forms chloride ions. The Cl₂ gas present in the emissions has a very low solubility in acidified water and passes through to the alkaline absorbing solution where

it undergoes hydrolysis to form a proton (H^+), chloride ion, and hypochlorous acid. Non-suppressed or suppressed ion chromatography (IC) is used for analysis of the chloride ion.

3.0 INTERFERENCES

Volatile materials that produce chloride ions upon dissolution during sampling are obvious interferences in the measurement of HCl. One likely interferent is Cl_2 , which disproportionates to HCl and hypochlorous acid (HClO) upon dissolution in water. Cl_2 exhibits a low solubility in water, however, and the use of acidic rather than neutral or basic solutions for collection of HCl greatly reduced the dissolution of any Cl_2 present in the emissions.

Reducing agents such as SO_2 may cause a positive bias in the chlorine measurement by the following reaction:



4.0 METHOD TARGET COMPOUNDS

chlorine
hydrogen chloride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

chlorine
hydrogen chloride

METHOD TO-1

Determination of Volatile Organic Compounds in Ambient Air Using TENAX® Adsorption and Gas Chromatography/Mass Spectrometry (GC/MS)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-1 is used to collect and determine volatile, non-polar organics (aromatic hydrocarbons, chlorinated hydrocarbons) that can be captured on Tenax® and determined by thermal desorption techniques. The compounds to be determined by this technique have boiling points in the range of 80-200°C.

2.0 SUMMARY OF METHOD

Air is drawn through a cartridge containing 1-2 g of Tenax®. The cartridge is analyzed in the laboratory and purged with an inert gas into first a gas chromatograph (GC) followed by a mass spectrometer (MS). Only capillary GC techniques should be used. The GC temperature is increased through a temperature program and the compounds are eluted from the column on the basis of boiling points. The MS identifies and quantifies the compounds by mass fragmentation patterns. Compound identification is normally accomplished using a library search routine on the basis of GC retention time and mass spectral characteristics.

3.0 INTERFERENCES

The most common interferences are structural isomers.

4.0 METHOD TARGET COMPOUNDS

aromatic hydrocarbons
chlorinated hydrocarbons

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

acrylonitrile
allyl chloride
benzene
bis(chloromethyl) ether
bromoform
1,3-butadiene
carbon disulfide
carbon tetrachloride
carbonyl sulfide
chlorobenzene
chloroform
chloromethyl methyl ether
chloroprene
cumene
1,4-dichlorobenzene
dichloroethyl ether
1,3-dichloropropene
1,1-dimethylhydrazine

1,4-dioxane
1,2-epoxybutane
ethyl acrylate
ethylbenzene
ethyl chloride
ethylene dibromide
ethylene dichloride
ethylene imine
ethylidene dichloride
hexachlorobuadiene
hexachloroethane
hexane
methyl bromide
methyl chloride
methyl chloroform
methyl ethyl ketone
methyl hydrazine
methylene chloride
methyl iodide
methyl isobutyl ketone
methyl isocyanate
methyl methacrylate
methyl tert-butyl ether
nitrobenzene
2-nitropropane
N-nitrosodimethylamine
propylene dichloride
propylene oxide
1,2-propyleneimine

styrene
1,1,2,2-tetrachloroethane
tetrachloroethylene
toluene
1,2,4-trichlorobenzene
trichloroethylene
2,2,4-trimethylpentane
vinyl acetate
vinyl bromide
vinyl chloride
vinylidene chloride
m, p, o-xylenes

METHOD TO-2

Determination of Volatile Organic Compounds in Ambient Air by Carbon Molecular Sieve Adsorption and Gas Chromatography/Mass Spectrometry (GC/MS)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-2 is used to collect and determine highly volatile, non-polar organics (vinyl chloride, vinylidene chloride, benzene, toluene) that can be captured on carbon molecular sieve and determined by thermal desorption techniques. The compounds to be determined by this technique have boiling points in the range of -15-120°C.

2.0 SUMMARY OF METHOD

Air is drawn through a cartridge containing 0.4 g of a carbon molecular sieve (CMS) adsorbent. The cartridge is analyzed in the laboratory by flushing with dry air to remove adsorbed moisture and purging the sample with helium while heating the cartridge to 350-400°C. The desorbed organics are collected in a cryogenic trap and flash evaporated into first a gas chromatograph (GC) followed by a mass spectrometer (MS). Only capillary GC techniques should be used. The GC temperature is increased through a temperature program and the compounds are eluted from the column on the basis of boiling points. The MS identifies and quantifies the compounds by mass fragmentation patterns. Compound identification is normally accomplished using a

library search routine on the basis of GC retention time and mass spectral characteristics.

3.0 INTERFERENCES

The most common interferences are structural isomers.

4.0 METHOD TARGET COMPOUNDS

benzene
toluene
vinyl chloride
vinylidene chloride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

allyl chloride
benzene
carbon tetrachloride
chloroform
ethyl chloride
ethylene dichloride
methyl bromide
methyl chloride
methyl chloroform
methylene chloride
toluene
trichloroethylene
vinyl bromide

vinyl chloride
vinylidene chloride

METHOD TO-4

Determination of Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs) in Ambient Air

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-4 is used to analyze a variety of organochlorine pesticides and polychlorinated biphenyls (PCBs) in ambient air.

2.0 SUMMARY OF METHOD

A modified high volume sampler consisting of a glass fiber filter with a polyurethane foam backup absorbent cartridge is used to sample air at a rate of 200-280 L/min. PCBs and pesticides are recovered by Soxhlet extraction with 5 percent ether in hexane. The extracts are reduced in volume with a Kuderna-Danish concentration technique and subject to column chromatography cleanup. The extracts are analyzed using gas chromatography with electron capture detection.

3.0 INTERFERENCES

Extraneous organic compounds may interfere. It may be difficult to identify an individual pesticide or PCBs in a multiple component mixture.

4.0 METHOD TARGET COMPOUNDS

organochlorine pesticides
polychlorinated biphenyls

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

DDE
heptachlor
lindane
methoxychlor
parathion
toxaphene

METHOD TO-5

Determination of Aldehydes and Ketones in Ambient Air Using High Performance Liquid Chromatography (HPLC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-5 is used to analyze individual aldehydes and ketones in ambient air.

2.0 SUMMARY OF METHOD

Air is drawn through a midjet impinger containing dinitrophenylhydrazine (DNPH) reagent and isooctane where the target compounds are derivatized. The organic fraction is evaporated to dryness and dissolved in methanol. The derivatives are determined using reverse phase high performance liquid chromatography HPLC with an ultra-violet detector.

3.0 INTERFERENCES

Isomeric aldehydes or ketones may be unresolved by the HPLC system.

4.0 METHOD TARGET COMPOUNDS

aldehydes

ketones

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

acetaldehyde

acetophenone

acrolein

formaldehyde

methyl ethyl ketone

methyl isobutyl ketone

propionaldehyde

quinone

trifluralin

METHOD TO-6

Determination of Phosgene in Ambient Air Using High Performance Liquid Chromatography (HPLC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-6 is used to determine phosgene in ambient air at the 0.1 ppbv level.

2.0 SUMMARY OF METHOD

Air is drawn through a midjet impinger containing an aniline/toluene mixture. The solution is heated to dryness and dissolved in acetonitrile. The sample is analyzed by reverse phase high performance liquid chromatography (HPLC) with an ultraviolet detector.

3.0 INTERFERENCES

Chloroformates and acidic materials may interfere.

4.0 METHOD TARGET COMPOUNDS

phosgene

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

phosgene

METHOD TO-7

Determination of N-Nitrosodimethylamine in Ambient Air Using Gas Chromatography (GC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-7 is used to determine N-nitrosodimethylamine in ambient air.

2.0 SUMMARY OF METHOD

Air is drawn through a Thermosorb/N adsorbent cartridge at a rate of 2 L/min. The cartridges are pre-eluted with dichloromethane to remove interferences. The sample is eluted with acetone and injected into a gas chromatograph (GC) that is followed by a detection system such as mass spectrometer (MS). A Carbowax 20M capillary column should be used in the GC. The GC temperature is increased through a temperature program and the compounds are eluted from the column on the basis of boiling points. The MS identifies and quantifies the compounds by mass fragmentation patterns. Compound identification is normally accomplished using a library search routine on the basis of GC retention time and mass spectral characteristics.

3.0 INTERFERENCES

Compounds with similar GC retention times and similar detectable MS ions may interfere.

4.0 METHOD TARGET COMPOUNDS

N-nitrosodimethylamine

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

N-nitrosodiethylamine

N-nitrosomorpholine

METHOD TO-8

Determination of Phenol and Methyl Phenols (Cresols) in Ambient Air using High Performance Liquid Chromatography (HPLC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-8 is used to determine cresols and phenols in ambient air at the 1-5 ppbv level.

2.0 SUMMARY OF METHOD

Air is drawn through two midjet impingers, each containing sodium hydroxide. The solution is adjusted to pH 4 in the laboratory after sampling, and analyzed by reverse-phase high performance liquid chromatography (HPLC) with ultraviolet, electrochemical, or fluorescent detection.

3.0 INTERFERENCES

Compounds having the same HPLC retention times will interfere with this method. The phenolic compounds of interest may be oxidized during sampling.

4.0 METHOD TARGET COMPOUNDS

cresols

phenols

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

cresylic acid

o-cresol

m-cresol

p-cresol

METHOD TO-9

Determination of Polychlorinated Di-Benzo-p-Dioxins (PCDDS) in Ambient Air Using High Resolution Gas Chromatography/High-Resolution Mass Spectrometry (HRGC/HRMS)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-9 is used to determine p-dioxins in ambient air, especially 1,2,3,4- and 2,3,7,8-tetrachlorodibenzo-p-dioxins (TCDDs), polychlorinated dibenzo-p-dioxins (HxCDDs) and octachlorodibenzo-p-dioxin (OCDD). With careful attention to reagent purity, the method can detect PCDDs at levels below 15 pg/m³.

2.0 SUMMARY OF METHOD

Air is drawn through a glass fiber filter with a polyurethane foam (PUF) back-up adsorbent cartridge. Silica gel can be used in place of PUF to give lower detection limits, but silica gel does not always give consistent sample recoveries and will require extensive clean-up. The filters and PUF adsorbent cartridge are extracted together with benzene, diluted with hexane and cleaned up using column chromatography. The sample is injected into a high resolution gas chromatograph (HRGC) in line with a high-resolution mass spectrometer (HRMS). In the HRGC, temperature is increased through a temperature program and the sample compounds are eluted from the column on the basis of boiling points. The HRMS identifies and quantifies the compounds by mass fragmentation patterns. Compound identification is normally accomplished using a

library search routine on the basis of HRGC retention time and mass spectral characteristics.

3.0 INTERFERENCES

Polychlorinated biphenyls (PCBs), methoxybiphenyls, chlorinated hydroxydiphenylethers and naphthalenes, DDE, DDT, and other compounds with similar retention times and mass fractions are analytical interferences. Inaccurate measurements can occur if PCDDs are retained or absorbed onto particulate matter, the filter, or PUF cartridge, or are chemically changed during sampling and storage in ways not traceable with isotopically labelled spikes.

4.0 METHOD TARGET COMPOUNDS

polychlorinated dibenzo-p-dioxins
polychlorinated dibenzofurans

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

dibenzofurans
2,3,7,8-tetrachlorodibenzo-p-dioxin

METHOD TO-10

Determination of Organochlorine Pesticides in Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling with Gas Chromatography/Electron Capture Detector (GC/ECD)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-10 is used to determine organochlorine pesticides in ambient air. This method is applicable to multi-component mixtures containing the compounds of interest in concentrations of 0.01 to 50 $\mu\text{g}/\text{m}^3$. The sampling procedure is also applicable to other pesticides that may be determined by gas chromatography coupled with a nitrogen-phosphorus detector, flame photometric detector, Hall electrolytic conductivity detector, or a mass spectrometer (MS). For some organopesticides, high performance liquid chromatography coupled with ultraviolet or electrochemical detection may be preferred.

2.0 SUMMARY OF METHOD

A low volume sampler is used to collect source vapors onto a sorbent cartridge containing polyurethane foam. Pesticides are extracted from the cartridge with 5 percent diethyl ether in hexane and recovered by Soxhlet extraction with 5 percent ether in hexane. The extracts are reduced in volume with a Kuderna-Danish concentration technique and subjected to an alumina chromatographic cleanup procedure. The sample

extracts are analyzed by gas chromatography coupled with an electron capture detector (ECD).

3.0 INTERFERENCES

ECD and other detectors (except the MS) will be subject to responses from a variety of compounds other than the compounds of interest. Polychlorinated biphenyls in particular may interfere. Certain organochlorine pesticides (e.g., chlordane) are complex mixtures of individual compounds that can make accurate quantification of a particular compound in the mixture difficult.

4.0 METHOD TARGET COMPOUNDS

organochlorine pesticides

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

captan
2,4-D salts and esters
DDE
heptachlor
lindane
methoxychlor
parathion
toxaphene
trifluralin

METHOD TO-11

Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-11 is used to determine formaldehyde in ambient air. Other aldehydes and ketones can be detected with a modification of the basic procedure.

2.0 SUMMARY OF METHOD

Air is drawn through a midjet impinger sampling train (without impinger) containing a silica gel cartridge coated with acidified dinitrophenylhydrazine (DNPH). The cartridge is eluted with acetonitrile in the laboratory to form a formaldehyde-DPNH derivative. The concentration of formaldehyde is determined with isocratic reverse phase high performance liquid chromatography (HPLC) with ultraviolet absorption detection.

3.0 INTERFERENCES

Isomeric aldehydes and ketones, and other compounds with the same HPLC retention times as formaldehyde may interfere with this method.

4.0 METHOD TARGET COMPOUNDS

formaldehyde

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

acetaldehyde

acetophenone

acrolein

2-chloroacetophenone

formaldehyde

isophorone

methyl ethyl ketone

methyl isobutyl ketone

phosgene

propionaldehyde

quinone

METHOD TO-13

Determination of Polynuclear Aromatic Hydrocarbons (PAHs) in Ambient Air Using High Volume Sampling with Gas Chromatography/Mass Spectrometry (GC/MS) and High Resolution Liquid Chromatographic (HRLC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-13 is used to determine benzo(a)pyrene and other polynuclear aromatic hydrocarbons (PAHs) in ambient air. Nitro-PAHs are not included with this method.

2.0 SUMMARY OF METHOD

Air is drawn through a filter and adsorbent cartridge containing XAD-2® or polyurethane foam. The filters and adsorbents are extracted by Soxhlet apparatus. The extract is reduced in volume with a Kuderna-Danish concentration technique and subjected to cleanup with silica gel column chromatography. The sample is further concentrated with a Kuderna-Danish evaporator and analyzed by either gas chromatography equipped with flame ionization or a mass spectrometer, or high performance liquid chromatography.

3.0 INTERFERENCES

Method interferences may be caused by contaminants in solvents, reagents, glassware, and sampling hardware. Matrix interferences may be caused by contaminants that are co-extracted with the sample. Heat, ozone, nitrogen dioxide, and ultraviolet light may cause sample degradation.

4.0 METHOD TARGET COMPOUNDS

polynuclear aromatic hydrocarbons

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

acetamide
acetophenone
2-acetylaminofluorene
acrylamide
acrylic acid
4-aminobiphenyl
aniine
o-anisidine
benzotrichloride
benzyl chloride
biphenyl
bis(2-ethylhexyl) phthalate
caprolactam
carbaryl
catechol
chloramben

chlordane
chloroacetic acid
2-chloroacetophenone
chlorobenzilate
o,m,p-cresol, cresylic acid
cumene
1,2-dibromo-3-chloropropane
dibutyl phthalate
1,4-dichlorobenzene
3,3'-dichlorobenzidine
dichloroethyl ether
dichlorvos
diethanolamine
N,N-diethylaniline
diethyl sulfate
3,3'-dimethoxybenzidine
dimethylaminoazobenzene
3,3'-dimethylbenzidine
dimethyl carbamoyl chloride
dimethyl formamide
dimethyl phthalate
dimethyl sulfate
4,6-dinitro-o-cresol and salts
2,4-dinitrophenol
2,4-dinitrotoluene
1,2-diphenylhydrazine
epichlorohydrin
ethyl carbamate
ethylene dibromide

ethylene glycol
ethylene thiourea
glycol ethers
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
hexamethylene-1,6-diisocyanate
hexamethylphosphoramide
hydroquinone
maleic anhydride
methoxychlor
methylene diphenyl isocyanate
4,4'-methylenedianiline
4,4'-methylene bis(2-chloroaniline)
naphthalene
4-nitrobiphenyl
4-nitrophenol
2-nitropropane
N-nitroso-N-methylurea
N-nitrosodimethylamine
N-nitrosomorpholine
pentachloronitrobenzene
pentachlorophenol
phenol
p-phenylenediamine
phthalic anhydride
polychlorinated biphenyls
1,3-propane sultone

beta-propiolactone
propoxur
quinoline
styrene oxide
2,4-toluenediamine
o-toludine
1,2,4-trichlorobenzene
2,4,5-trichlorophenol
2,4,6-trichlorophenol
triethylamine
o-, m-, p-xylenes

METHOD TO-14

Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA® Polished Canister Sampling and Gas Chromatography (GC)

REFERENCE:

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. U.S. Environmental Protection Agency. EPA-600/4-89-017 (Supplements: 600/4-87-006, 600/4-87-013).

1.0 SCOPE AND APPLICATION

Method TO-14 is used to determine semi-volatile and volatile organic compounds in ambient air. The sample canisters can be placed above or below atmospheric pressure. Pressurized samples can be detected at the ppbv level.

2.0 SUMMARY OF METHOD

Air is drawn through a sampling train into a pre-evacuated sample SUMMA® canister. The canister is attached to the analytical system. Water vapor is reduced in the gas stream by a Nafion dryer and VOCs are concentrated by collection into a cryogenically-cooled trap. The cryogen is removed and the temperature of the sample raised to volatilize the sample into a high resolution gas chromatograph (HRGC). The GC temperature is increased through a temperature program and the compounds are eluted from the column on the basis of boiling points into a detector. The choice of detector depends on the specificity and sensitivity required by the analysis. Non-specific detectors include nitrogen-phosphorus detectors, flame ionization detectors, electron capture detectors, and photoionization detectors. Specific detectors include a mass spectrometer (MS) operating in the selected ion mode or the SCAN mode, or an ion

trap detector. Identification errors can be reduced by employing simultaneous detection by different detectors.

3.0 INTERFERENCES

Interferences can occur because of moisture contamination in the dryer. Polar organic compounds may be lost with moisture removed in the GC/MS dryer.

4.0 METHOD TARGET COMPOUNDS

semi-volatile organic compounds
volatile organic compounds
Freons®

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

acetonitrile
acrylonitrile
allyl chloride
benzene
bis(chloromethyl) ether
bromoform
1,3-butadiene
carbon disulfide
carbon tetrachloride
carbonyl sulfide
chlorobenzene
chloroform
chloromethyl methyl ether

chloroprene
cumene
1,4-dichlorobenzene
dichloroethyl ether
1,3-dichloropropene
1,1-dimethylhydrazine
1,4-dioxane
1,2-epoxybutane
ethyl acrylate
ethylbenzene
ethyl chloride
ethylene dibromide
ethylene dichloride
ethylene imine
ethylene oxide
ethylidene dichloride
hexachlorobutadiene
hexachloroethane
hexane
methanol
methyl bromide
methyl chloride
methyl chloroform
methyl ethyl ketone
methyl hydrazine
methylene chloride
methyl iodide
methyl isobutyl ketone
methyl isocyanate

methyl methacrylate
methyl tert-butyl ether
nitrobenzene
2-nitropropane
propylene dichloride
propylene oxide
1,2-propyleneimine
styrene
1,1,2,2-tetrachloroethane
tetrachloroethylene
toluene
trichloroethylene
2,2,4-trimethylpentane
vinyl acetate
vinyl bromide
vinyl chloride
vinylidene chloride
o-, m-, p-xylenes

CARB METHOD 427

Determination of Asbestos Emissions from Stationary Sources

REFERENCE:

Stationary Source Test Methods, Volume III: Methods for Determining Emissions of Toxic Air Contaminants from Stationary Sources. State of California Air Resources Board, Monitoring and Laboratory Division. Sacramento, CA: 1989.

1.0 SCOPE AND APPLICATION

CARB Method 427 is used to determine asbestos emissions from stationary sources. The method describes a stack sampling method, but an alternate non-stack method (NIOSH Method 7400) can be used. The method of analysis described in NIOSH 7400 (light microscopy), and permitted under Method 427, does not distinguish asbestos from other mineral fibers.

2.0 SUMMARY OF METHOD

The method consists of a stack sampling train designed to isokinetically collect a particulate sample from a known sample of gas, corrected to a dry basis. A probe is used to withdraw the sample isokinetically from the duct. A tared filter in filter holder is placed behind the probe within the stack to collect the bulk of the particulate sample. A series of impingers or a condenser following the filter assembly outside the stack is used to both measure the moisture present in the gas and protect the dry gas meter that is located at the end of the train.

The sample is composed of the particulate-laden filter and the dried washings of the probe, nozzle, and front half of the filter holder. Transmission electron microscopy

(TEM) can be used to analyze the collected sample. TEM analysis is used to classify the fibers as chrysotile, amphibole, or non-asbestos and to describe the aggregation of asbestos into single fibers, bundles, or mats.

3.0 INTERFERENCES

Phase contrast light microscopy will not differentiate between asbestos and other mineral fibers.

4.0 METHOD TARGET COMPOUNDS

asbestos

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

asbestos

mineral fibers

CARB Method 429

Determination of Polycyclic Aromatic Hydrocarbon (PAH) Emissions from Stationary Sources

REFERENCE:

Stationary Source Test Methods, Volume III: Methods for Determining Emissions of Toxic Air Contaminants from Stationary Sources. State of California Air Resources Board, Monitoring and Laboratory Division. Sacramento, CA: 1989.

1.0 SCOPE AND APPLICABILITY

CARB Method 429 is used to determine polycyclic aromatic hydrocarbon (PAH) emissions from stationary sources. The sensitivity that can ultimately be achieved for a given sample will depend upon the types and concentrations of other chemical compounds in the sample, as well as the original sample size and instrument sensitivity.

The limitations on extension of the methodology to compounds other than the method target compounds listed in Section 4.0 are the availability of standards and the ability to perform chromatographic separations on vaporized compounds.

2.0 SUMMARY OF METHOD

Particulate and gaseous-phase PAH are extracted isokinetically from the stack and collected on a filter, on XAD-2® resin, in the impingers, or in upstream sampling train components. Only the total amounts of each PAH in stack emissions can be determined with this method. It has not been demonstrated that the partitioning in the different parts of the sampling train is representative of the partitioning in the stack gas sample for particulate and gaseous PAH.

The analytical method entails the addition of internal standards to all samples in known quantities, matrix-specific extraction of the sample with appropriate organic solvents, preliminary fractionation and cleanup of extracts (if necessary), and analysis of the processed extract for PAH using high-resolution capillary column gas chromatography coupled with either low resolution or high resolution mass spectrometry.

3.0 INTERFERENCES

Modified Method 5 sampling train can cause artifactual formation and PAH transformation. The fact that PAH can degrade or transform on sample filters is well documented. When trapped on filters, certain reactive PAH such as benzo[a]pyrene, benzo[a]anthracene, and fluoranthene can readily react with stack gases. Low levels of nitric acid and higher levels of nitrogen oxides, ozone, and sulfur oxides have been known to react with these PAH.

PAH degradation may be of even greater concern when they are trapped in the impingers. When stack gases such as sulfur oxides and nitrogen oxides come in contact with the impinger water, they are converted into sulfuric acid and nitric acid, respectively. There is evidence that under such conditions certain PAH will be degraded. It is recommended that the levels in the impingers be used as a qualitative tool to determine if breakthrough has occurred in the resin.

In order to assess the effects of ozone, sulfur oxides, and nitrogen oxides, the tester should monitor concurrently for these gases during PAH sampling.

4.0 METHOD TARGET COMPOUNDS

naphthalene
acenaphthylene
acenaphthene
fluorene
phenanthrene
anthracene
fluoranthene
pyrene
benz[a]anthracene
chrysene
benzo[b]fluoranthene
benzo[k]fluoranthene
benzo[a]pyrene
benzo[ghi]perylene
dibenz[a,h]anthracene
indeno[1.2.3-cd]pyrene

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

polycyclic organic matter

CARB METHOD 431

Determination of Ethylene Oxide Emissions from Stationary Sources

REFERENCE:

Stationary Source Test Methods, Volume III: Methods for Determining Emissions of Toxic Air Contaminants from Stationary Sources. State of California Air Resources Board, Monitoring and Laboratory Division. Sacramento, CA: 1989.

1.0 SCOPE AND APPLICATION

CARB Method 431 is used to determine ethylene oxide emissions from sterilization chambers in pounds per sterilization cycle. The method can be modified to determine emissions of ethylene oxide from other stationary sources.

2.0 SUMMARY OF METHOD

A sterilization chamber is operated empty of items to be sterilized, minimizing interferences and simulating worst-case vented emission conditions. Volumetric flow of vented gas is monitored and vented gas is analyzed repeatedly by gas chromatography during chamber purging. Total emissions of ethylene oxide for the sterilization cycle are calculated from curves of flow and concentration over time.

Ethylene oxide is used in sterilizers at lethal concentrations. Contact with vented gas can cause skin burns. Inhalation can cause injury or death. Caution should be observed to avoid contact with or inhalation of vented gas.

The lower limit of sensitivity will vary according to the gas chromatography equipment and span gases used. With appropriate span gases the method is expected to

achieve useful accuracy over the expected range of emissions from either controlled or uncontrolled sterilizers.

3.0 INTERFERENCES

Ethylene oxide is frequently used in sterilizers in a mixture with dichlorodifluoromethane (Freon 12). If the gas chromatographic conditions are not well selected, the ethylene oxide peak may be overwhelmed by the tail of the Freon 12 peak when testing emissions at low concentrations. This matrix problem is effectively eliminated by selecting a gas chromatographic column where ethylene oxide elutes before Freon 12.

4.0 METHOD TARGET COMPOUNDS

ethylene oxide

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

ethylene oxide

NIOSH METHOD 2515

Diazomethane

REFERENCE:

NIOSH Manual of Analytical Methods, Part 1: NIOSH Monitoring Methods, Volume 1.
U.S. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health. Cincinnati, Ohio: Revised 1985.

1.0 SCOPE AND APPLICATION

NIOSH Method 2515 is used to determine 0.1 to 0.6 ppm (0.2 to 1 mg/m³) diazomethane for a 10 L air sample.

2.0 SUMMARY OF METHOD

An air sample is obtained using a solid sorbent tube (octanoic acid-coated XAD-2® resin, 100 mg/50 mg) attached to a personal sampling pump with flexible tubing. The sample is collected at a known flow rate of 0.2 ± 0.03 L/min for a total sample size of 6 to 30 L.

Analysis is by gas chromatography (GC) with flame ionization detector. A stainless steel column, 3 m x 3 mm OD with 5% SP-1000 on 100/120 mesh Chromosorb WHP preceded by a 15 cm x 3 mm OD stainless steel precolumn 80/100 mesh Gas Chrom Q is recommended.

Methyl octanoate (analyte) is desorbed in carbon disulfide with an internal standard (tridecane) for daily calibration over a range of 1 to 32 µg methyl octanoate per sample. The GC is set according to recommendations and conditions given in this

method for optimum and the peak resolution samples are injected manually using the solvent flush technique or with an autosampler.

The concentration of diazomethane per sample is calculated by converting mg methyl octanoate to mg diazomethane by multiplying the corrected mg per sample by the molecular weight ratio, 41.04/158.24, and calculating the apparent concentration of diazomethane in the air volume sampled.

3.0 INTERFERENCES

The collection efficiency and reaction of diazomethane with the octanoic acid-coated resin may be strongly dependent on sample flow rates; therefore, all samples must be collected at a flow rate of 0.2 L/min only.

4.0 METHOD TARGET COMPOUNDS

diazomethane

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

diazomethane

NIOSH METHOD 7400

Fibers

REFERENCE:

NIOSH Manual of Analytical Methods, Part 1: NIOSH Monitoring Methods, Volume 1.
U.S. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health. Cincinnati, Ohio: Revised 1985.

1.0 SCOPE AND APPLICATION

NIOSH Method 7400 gives an index of airborne fibers but will not differentiate asbestos from other mineral fibers. Fibers less than $0.25\ \mu\text{m}$ will not be detected by this method.

2.0 SUMMARY OF METHOD

A sample is withdrawn through a 0.8 to $1.2\ \mu\text{m}$ ester membrane filter in a 25 mm cassette filter holder at 0.5 to 16 L/min. The sample is prepared according to the acetone/triacetin "hot block" method onto a phase-shift test slide. The fibers are counted manually using a light microscope and a Walton-Beckett graticule.

3.0 INTERFERENCES

Any airborne fibers may interfere as all particles meeting the counting criteria will be counted. Chain-like fibers may appear fibrous. High levels of non-fibrous dust particles may obscure fibers in the field of view and increase the detection limit.

4.0 METHOD TARGET COMPOUNDS

asbestos

various mineral fibers

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

asbestos

fine mineral fibers

NIOSH METHODS 9010 AND 9012

Total and Amenable Cyanide Analysis

REFERENCE:

NIOSH Manual of Analytical Methods, Part 1: NIOSH Monitoring Methods, Volume 1.
U.S. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health. Cincinnati, Ohio: Revised 1985.

1.0 SCOPE AND APPLICATION

NIOSH Methods 9010 and 9012 are used to analyze an aqueous sample for total inorganic cyanide. The methods detect simple soluble salts or complex radicals, total cyanide, and cyanide amenable to chlorination.

2.0 SUMMARY OF METHOD

The sample is refluxed with strong acid and distilled into an absorber/scrubber that contains sodium hydroxide solution. Cyanide is released as hydrogen cyanide. The cyanide ion is converted to cyanochloride by reaction with chloramin-T at a pH less than 8. Color is formed by addition of pyridine-barbituric acid reagent. The concentration of cyanide ion is determined colorimetrically (UV) either manually (Method 9010) or with an automated system (Method 9012) by comparison to known standards.

3.0 INTERFERENCES

Sulfides, nitrates, or nitrites adversely affect the colorimetric procedure but can be eliminated as interferences by pretreating the sample.

4.0 METHOD TARGET COMPOUNDS

inorganic cyanide

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

cyanide compounds

OSHA METHOD ID-101

Chlorine in Workplace Atmospheres

REFERENCE:

OSHA Method ID-101

1.0 SCOPE AND APPLICATION

The method describes the collection and analysis of airborne chlorine for industries where chlorine is used as a bleaching agent or for chlorination of various organic compounds.

2.0 SUMMARY OF METHOD

An air sample is drawn into a solution of 0.1 percent sulfamic acid. An aliquot of the sample is reacted with acidic potassium iodide. Chlorine oxidizes the potassium iodide to iodine which is measured by an ion specific electrode. The detection limit is 0.4 mg/m³ for a 15 liter air volume.

3.0 INTERFERENCES

Strong oxidizing agents including iodate, bromine, cupric ion and manganese dioxide can interfere with the analysis. High silver and mercuric concentrations (greater than 15 ppm) also can cause interference.

4.0 METHOD TARGET COMPOUNDS

Chlorine.

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

Chlorine.

EPA METHOD 6

Determination of Sulphur Dioxide Emissions from Stationary Sources

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40, Part 60, Appendix A. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

EPA Method 6 is used to determine sulphur dioxide (SO₂) emissions from stationary sources.

2.0 SUMMARY OF METHOD

A heated probe is used to collect a sample from the source. The probe is equipped with a filter (either in or out of stack) to remove particulates and sulfuric acid mist (including sulphur trioxide). The sample is collected in impingers filled with isopropanol and hydrogen peroxide. The concentration of SO₂ is determined by titration of the sample with barium perchlorate to a thorin endpoint.

The impinger solution can be modified to allow sampling/analysis of other compounds.

3.0 INTERFERENCES

Free ammonia, water soluble cations, and fluorides may interfere.

4.0 METHOD TARGET COMPOUNDS

sulphur dioxide

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

ammonia

cyanide

EPA METHODS 7C AND 7D

Determination of Nitrogen Oxide Emissions from Stationary Sources-Alkaline-Permanganate Methods

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40, Part 60, Appendix A. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

EPA Methods 7C and 7D are used to determine nitrogen oxide (NO_x) emissions from fossil-fuel fired steam generators, electric utility plants, nitric acid plants, among other sources.

2.0 SUMMARY OF METHOD

An integrated sample is collected in a heated probe packed with glass wool for particulate collection. The sample is passed through a series of impingers containing alkaline potassium permanganate solution. NO_x is oxidized to nitrate ions. The nitrate is reduced to nitrite with cadmium and the nitrite is analyzed colorimetrically (Method 7C) or is analyzed as nitrate by ion chromatography (Method 7D) against known standards. The detection limits are 7 ppm NO_x when sampling at 500 cc/min for 1 hour.

3.0 INTERFERENCES

~~Sulphur~~ dioxide and ammonia may interfere.

4.0 METHOD TARGET COMPOUNDS

nitrogen dioxide

nitrogen oxide

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

phosphine

EPA METHOD 12

Determination of Inorganic Lead Emissions from Stationary Sources

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40, Part 60, Appendix A. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

This method applies to the determination of inorganic lead emissions from specified stationary sources only.

2.0 SUMMARY OF METHOD

Particulate and gaseous lead emissions are withdrawn isokinetically from the source and collected on a filter and in dilute nitric acid. The collected samples are digested in acid solution and analyzed by atomic absorption spectrometry using an air acetylene flame.

3.0 INTERFERENCES

Sample matrix effects may interfere with the analysis for lead by flame atomic absorption. If matrix interference is suspected, the analyst may confirm the presence of these matrix effects and frequently eliminate the interference by using the Method of Standard Additions.

High concentrations of copper may interfere with the analysis for lead at 217.0 nm. This interference can be avoided by analyzing the samples at 283.3 nm.

4.0 METHOD TARGET COMPOUNDS

lead compounds

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

lead compounds

EPA METHOD 13A

Determination of Total Fluoride Emissions from Stationary Sources by the SPADNS Zirconium Lake Method

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 13A is used to determine fluoride emissions from stationary sources. It does not measure fluorocarbons.

2.0 SUMMARY OF METHOD

Gaseous and particulate fluoride are withdrawn isokinetically from the source through a heated probe. A filter (with optional heating) is placed either before the first impinger or between the third and fourth impinger. The sample is collected in impingers containing deionized water and analyzed spectrophotometrically after distillation and addition of SPADNS reagent [4,5 dihydroxy-3-(p-sulfophenylazo)-2,7-naphthalene-disulfonic acid trisodium salt]. The range of this method is 0 to 1.4 $\mu\text{g F/mL}$. The sensitivity has not been determined.

3.0 INTERFERENCES

Large quantities of chloride will interfere with the analysis. Grease on sample-exposed surfaces may cause low results because of adsorption of fluoride.

4.0 METHOD TARGET COMPOUNDS

fluoride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

hydrogen fluoride

EPA METHOD 13B

Determination of Total Fluoride Emissions from Stationary Sources by Specific Ion Electrode Method

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 13B is used to determine fluoride emissions from stationary sources. It does not measure fluorocarbons.

2.0 SUMMARY OF METHOD

Gaseous and particulate fluoride are withdrawn isokinetically from the source through a probe heated filter and collected in impingers containing deionized water. The sample is analyzed after distillation by a specific ion electrode that is calibrated with known standards.

3.0 INTERFERENCES

Grease on sample-exposed surfaces may cause low results because of adsorption of fluoride.

4.0 METHOD TARGET COMPOUNDS

fluoride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

hydrogen fluoride

EPA METHOD 14
Determination of Fluoride from Roof Monitors

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 14 is used to determine fluoride emissions from potroom roof monitors for primary aluminum plants when specified by New Source Performance Standards. It does not measure fluorocarbons.

2.0 SUMMARY OF METHOD

The sample is drawn into a manifold that is connected to a duct. A sample is withdrawn from the duct isokinetically and analyzed, either spectrophotometrically or by use of a specific ion electrode.

3.0 INTERFERENCES

Large quantities of chloride will interfere with the analysis. Grease on sample-exposed surfaces may cause low results because of adsorption of fluoride.

4.0 METHOD TARGET COMPOUNDS

fluoride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

hydrogen fluoride

EPA METHOD 15

Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide from Stationary Sources

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 15 is used to determine hydrogen sulfide, carbonyl sulfide, and carbon disulfide from tail gas control units of sulfur recovery plants. Any method that uses the principle of gas chromatography separation with flame photometric detection can be substituted, providing that sample-line loss and the calibration precision are met.

2.0 SUMMARY OF METHOD

Gas is drawn through a heated sample probe followed by a particulate filter (Teflon®) outside the stack. A sulfur dioxide (SO₂) scrubber made up of impingers containing citrate buffer removes SO₂ from the sample. The sample then is diluted with clean dry air (9:1) and fed into a gas chromatograph (GC) equipped with a flame photometric detector ((FPD). In the GC, temperature is increased through a temperature program and the compounds of interest are eluted from the column on the basis of boiling point. Concentrations of the sulfur compounds of interest are determined by calibration of the GC/FPD against known standards. The minimum detectable quantity depends on the sample size and would be about 0.5 ppm for a 1 mL sample.

3.0 INTERFERENCES

Moisture, carbon monoxide, carbon dioxide, SO₂, elemental sulfur, and alkali mist are possible interferences.

4.0 METHOD TARGET COMPOUNDS

carbon disulfide

carbonyl sulfide

hydrogen sulfide

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

carbon disulfide

carbonyl sulfide

EPA METHOD 18

Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

REFERENCE:

40 CFR Part 60, Appendix A.

1.0 SCOPE AND APPLICATION

EPA Method 18 is used to analyze approximately 90 percent of the total gaseous organics emitted from an industrial source.

Method 18 does not include techniques to identify and measure trace amounts of organic compounds such as those found in building air and fugitive emission sources. This method will not determine compounds that: (1) are polymeric (high molecular weight); (2) can polymerize before analysis; or (3) have very low vapor pressures at stack or instrument conditions.

2.0 SUMMARY OF METHOD

A presurvey must be performed on each source to be tested. The purpose of the presurvey is to obtain all information necessary to design the emission test. The most important presurvey data are the average stack temperature and temperature range, approximate particulate concentration, static pressure, water vapor content, and identity and expected concentration of each organic compound to be analyzed. Some of this information can be obtained from literature surveys, direct knowledge, or plant personnel. However, presurvey samples of the gas shall be obtained for analysis to confirm the identity and approximate concentrations of the specific compounds prior to

the final testing. The presurvey samples shall be used to develop and confirm the best sampling and analysis scheme.

The major components of a gas mixture are separated with a gas chromatograph (GC) and measured with a suitable detector. The retention time of each separated component is compared with the retention time of a known compound under identical conditions. Therefore, the analyst confirms the identity and approximate concentration of the organic emission components beforehand. With this information, the analyst then prepares or purchases commercially available standard mixtures to calibrate the GC under conditions identical to those of the samples. The analyst also determines the need for sample dilution to avoid detector saturation, gas stream filtration to eliminate particulate matter, and prevention of moisture condensation. The range of this method is from about 1 part per million (ppm) to the upper limit governed by GC detector saturation or column overloading. The upper limit can be extended by diluting the stack gases with an inert gas or by using smaller gas sampling loops.

The sensitivity limit for a compound is defined as the minimum detectable concentration of that compound, or the concentration that produces a signal-to-noise ratio of three to one. The minimum detectable concentration is determined during the presurvey calibration for each compound. Gas chromatographic techniques typically provide a precision of 5 to 10 percent relative standard deviation (RSD), but an experienced GC operator with a reliable instrument can readily achieve a 5 percent RSD. For this method, the following combined GC/operator values are required:

1. Precision -- duplicate analyses are within 5 percent of their mean value.
2. Accuracy -- analysis results of prepared audit samples are within 10 percent of preparation values.

3.0 INTERFERENCES

Chromatographic resolution interferences that may occur can be eliminated by appropriate GC column and detector choice or by shifting the retention times through changes in the column flow rate and the use of temperature programming. If chromatographic resolution cannot be achieved by application of these techniques, quantitative results cannot be obtained from the application of this method.

The analytical system is demonstrated to be essentially free from contaminants by periodically analyzing blanks that consist of hydrocarbon-free air or nitrogen. Sample cross-contamination that occurs when high-level and low-level samples or standards are analyzed alternately is best dealt with by thorough purging of the GC sample loop between samples.

To ensure consistent detector response, calibration gases are contained in dry air. To eliminate errors in concentration calculations due to the volume of water vapor in the samples, moisture concentrations are determined for each sample and a correction factor is applied to any sample with greater than 2 percent water vapor.

4.0 METHOD TARGET COMPOUNDS

gaseous organics

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetaldehyde
allyl chloride
1,3-butadiene
carbon disulfide

carbonyl sulfide
chloroprene
ethyl chloride
ethylene imine
ethylene oxide
formaldehyde
hydrazine
methanol
methyl bromide
methyl chloride
methyl iodide
methyl isocyanate
methylene chloride
phosgene
propylene oxide
1,2-propylene imine
vinyl bromide
vinyl chloride

EPA METHOD 13B

Determination of Total Fluoride Emissions from Stationary Sources by Specific Ion Electrode Method

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 13B is used to determine fluoride emissions from stationary sources. It does not measure fluorocarbons.

2.0 SUMMARY OF METHOD

Gaseous and particulate fluoride are withdrawn isokinetically from the source through a probe heated filter and collected in impingers containing deionized water. The sample is analyzed after distillation by a specific ion electrode that is calibrated with known standards.

3.0 INTERFERENCES

Grease on sample-exposed surfaces may cause low results because of adsorption of fluoride.

EPA METHOD 14
Determination of Fluoride from Roof Monitors

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 14 is used to determine fluoride emissions from potroom roof monitors for primary aluminum plants when specified by New Source Performance Standards. It does not measure fluorocarbons.

2.0 SUMMARY OF METHOD

The sample is drawn into a manifold that is connected to a duct. A sample is withdrawn from the duct isokinetically and analyzed, either spectrophotometrically or by use of a specific ion electrode.

3.0 INTERFERENCES

Large quantities of chloride will interfere with the analysis. Grease on sample-exposed surfaces may cause low results because of adsorption of fluoride.

EPA METHOD 15

Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide from Stationary Sources -

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 15 is used to determine hydrogen sulfide, carbonyl sulfide, and carbon disulfide from tail gas control units of sulfur recovery plants. Any method that uses the principle of gas chromatography separation with flame photometric detection can be substituted, providing that sample-line loss and the calibration precision are met.

2.0 SUMMARY OF METHOD

Gas is drawn through a heated sample probe followed by a particulate filter (Teflon®) outside the stack. A sulfur dioxide (SO₂) scrubber made up of impingers containing citrate buffer removes SO₂ from the sample. The sample then is diluted with clean dry air (9:1) and fed into a gas chromatograph (GC) equipped with a flame photometric detector ((FPD). In the GC, temperature is increased through a temperature program and the compounds of interest are eluted from the column on the basis of boiling point. Concentrations of the sulfur compounds of interest are determined by calibration of the GC/FPD against known standards. The minimum detectable quantity depends on the sample size and would be about 0.5 ppm for a 1 mL sample.



 5

 Monoxide, carbon dioxide, SO₂, elemental sulfur, and alkali mist

LET COMPOUNDS

 ide

 ide

 ide

AMENDMENTS POLLUTANTS

 ide

 ide

EPA METHOD 18

Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

REFERENCE:

40 CFR Part 60, Appendix A.

1.0 SCOPE AND APPLICATION

EPA Method 18 is used to analyze approximately 90 percent of the total gaseous organics emitted from an industrial source.

Method 18 does not include techniques to identify and measure trace amounts of organic compounds such as those found in building air and fugitive emission sources. This method will not determine compounds that: (1) are polymeric (high molecular weight); (2) can polymerize before analysis; or (3) have very low vapor pressures at stack or instrument conditions.

2.0 SUMMARY OF METHOD

A presurvey must be performed on each source to be tested. The purpose of the presurvey is to obtain all information necessary to design the emission test. The most important presurvey data are the average stack temperature and temperature range, approximate particulate concentration, static pressure, water vapor content, and identity and expected concentration of each organic compound to be analyzed. Some of this information can be obtained from literature surveys, direct knowledge, or plant personnel. However, presurvey samples of the gas shall be obtained for analysis to confirm the identity and approximate concentrations of the specific compounds prior to

the final testing. The presurvey samples shall be used to develop and confirm the best sampling and analysis scheme.

The major components of a gas mixture are separated with a gas chromatograph (GC) and measured with a suitable detector. The retention time of each separated component is compared with the retention time of a known compound under identical conditions. Therefore, the analyst confirms the identity and approximate concentration of the organic emission components beforehand. With this information, the analyst then prepares or purchases commercially available standard mixtures to calibrate the GC under conditions identical to those of the samples. The analyst also determines the need for sample dilution to avoid detector saturation, gas stream filtration to eliminate particulate matter, and prevention of moisture condensation. The range of this method is from about 1 part per million (ppm) to the upper limit governed by GC detector saturation or column overloading. The upper limit can be extended by diluting the stack gases with an inert gas or by using smaller gas sampling loops.

The sensitivity limit for a compound is defined as the minimum detectable concentration of that compound, or the concentration that produces a signal-to-noise ratio of three to one. The minimum detectable concentration is determined during the presurvey calibration for each compound. Gas chromatographic techniques typically provide a precision of 5 to 10 percent relative standard deviation (RSD), but an experienced GC operator with a reliable instrument can readily achieve a 5 percent RSD. For this method, the following combined GC/operator values are required:

1. Precision -- duplicate analyses are within 5 percent of their mean value.
2. Accuracy -- analysis results of prepared audit samples are within 10 percent of preparation values.

3.0 INTERFERENCES

Chromatographic resolution interferences that may occur can be eliminated by appropriate GC column and detector choice or by shifting the retention times through changes in the column flow rate and the use of temperature programming. If chromatographic resolution cannot be achieved by application of these techniques, quantitative results cannot be obtained from the application of this method.

The analytical system is demonstrated to be essentially free from contaminants by periodically analyzing blanks that consist of hydrocarbon-free air or nitrogen. Sample cross-contamination that occurs when high-level and low-level samples or standards are analyzed alternately is best dealt with by thorough purging of the GC sample loop between samples.

To ensure consistent detector response, calibration gases are contained in dry air. To eliminate errors in concentration calculations due to the volume of water vapor in the samples, moisture concentrations are determined for each sample, and a correction factor is applied to any sample with greater than 2 percent water vapor.

4.0 METHOD TARGET COMPOUNDS

gaseous organics

5.0 APPLICABLE CLEAN AIR ACT LIST COMPOUNDS

acetaldehyde
allyl chloride
1,3-butadiene
carbon disulfide

carbonyl sulfide
chloroprene
ethyl chloride
ethylene imine
ethylene oxide
formaldehyde
hydrazine
methanol
methyl bromide
methyl chloride
methyl iodide
methyl isocyanate
methylene chloride
phosgene
propylene oxide
1,2-propylene imine
vinyl bromide
vinyl chloride

EPA METHOD 23

Determination of Polychlorinated Dibenzo-p-dioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) from Stationary Sources

REFERENCE:

Federal Register, February 13, 1991 (56 FR 5758). To be included in 40 CFR Part 60, Appendix A.

1.0 SCOPE AND APPLICATION

EPA Method 23 is used to determine polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) from stationary sources.

2.0 SUMMARY OF METHOD

A sample is withdrawn isokinetically from the stack through a probe, a filter, and a trap packed with a solid adsorbent. The PCDDs and the PCDFs are collected in the probe, on the filter, and on the solid adsorbent.

The sampling train used in this method is identical to that described in EPA Method 5 with the exceptions and modifications noted within this method.

The sample is analyzed using a gas chromatograph coupled to a mass spectrometer (GC/MS). A 1 to 5 μ L aliquot of the sample extract is injected into the GC and measured with the MS. The total PCDDs and PCDFs are the sum of the individual isomers. Strict identification criteria for PCDDs and PCDFs are listed in the

method. Fused silica capillary columns are required, and one of the following is recommended:

- DB-5, 0.25 μm film thickness; or
- SP-2331 column to measure the 2,3,7,8-tetrachlorodibenzofuran isomer.

Two types of calibration procedures are required: an initial calibration is required before any samples are analyzed and intermittently calibrations are performed throughout sample analyses. The routine calibration consists of analyzing the column performance check solution and a concentration calibration solution.

The peak areas for the two ions monitored for each analyte are summed to yield the total response for each analyte. Each internal standard is used to quantify the PCDDs or PCDFs in its homologous series.

3.0 INTERFERENCES

PCDDs and PCDFs are often associated with other interfering chlorinated compounds such as polychlorinated biphenyls (PCBs) and polychlorinated diphenyl ethers, which may be found at higher concentrations than those of the analytes of interest.

4.0 METHOD TARGET COMPOUNDS

2,3,7,8-tetrachlorocibenzo-p-dioxin
2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-pentachlorodibenzo-p-dioxin
1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-pentachlorodibenzofuran

2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-hexachlorodibenzo-p-dioxin
2,3,4,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-heptachlorodibenzofuran
octachlorodibenzo-p-dioxin
octachlorodibenzofuran

5.0 APPLICABLE CLEAN AIR ACT CHEMICALS

dibenzofurans
2,3,7,8-tetrachlorodibenzo-p-dioxin

EPA METHOD 101

Determination of Particulate and Gaseous Mercury Emissions from Chlor-Alkali Plants - Air Streams

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40, Part 60, Appendix B. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

This method applies to the determination of particulate and gaseous mercury emissions from chlor-alkali plants and other sources (as specified in the regulations), where the carrier gas in the duct or stack is principally air.

2.0 SUMMARY OF METHOD

Particulate and gaseous mercury emissions are withdrawn isokinetically from the source and collected in acidic iodine monochloride solution. The mercury collected (in the mercuric form) is reduced to elemental mercury, which is then aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry.

3.0 INTERFERENCES

Sampling SO_2 reduces iodine monochloride and causes premature depletion of the iodine monochloride.

Iodine monochloride concentrations greater than 10^{-4} molar inhibit the reduction of the Hg^{II} in the aeration cell. Condensation of water vapor on the optical cell windows causes a positive interference.

4.0 METHOD TARGET COMPOUNDS

mercury compounds

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

mercury compounds

EPA METHOD 101A

Determination of Particulate and Gaseous Mercury Emissions from Sewage Sludge Incinerators

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40 CFR, Part 61, Appendix B. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

EPA Method 101A applies to the determination of particulate and gaseous mercury emissions from sewage sludge incinerators and other sources as specified in the regulations.

2.0 SUMMARY OF METHOD

This method is similar to EPA Method 101, except acidic potassium permanganate solution is used instead of acidic iodine monochloride for collection.

Particulate and gaseous mercury emissions are withdrawn isokinetically from the source and collected in acidic potassium permanganate solution. The mercury collected (in the mercuric form) is reduced to elemental mercury, which is then aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry.

3.0 INTERFERENCES

Excessive oxidizable organic matter in the stack gas prematurely depletes the potassium permanganate solution and prevents further collection of mercury.

Condensation of water vapor on the optical cell windows causes a positive interference.

4.0 METHOD TARGET COMPOUNDS

mercury compounds

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

mercury compounds

EPA METHOD 103
Beryllium Screening Method

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40 CFR, Part 61, Appendix B. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICABILITY

EPA Method 103 details guidelines and requirements for methods acceptable for use in determining beryllium emissions in ducts or stacks at stationary sources.

2.0 SUMMARY OF METHOD

Beryllium emissions are isokinetically sampled from three points in a duct or stack. The collected sample is analyzed for beryllium using an appropriate analytical technique.

3.0 INTERFERENCES

Not specified in Method.

4.0 METHOD TARGET COMPOUNDS

beryllium compounds

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

beryllium compounds

EPA METHOD 104

Reference Method for Determination of Beryllium Emissions from Stationary Sources

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40 CFR, Part 61, Appendix B. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

EPA Method 104 is applicable to the determination of beryllium emissions in ducts or stacks at stationary sources. Unless otherwise specified, this method is not intended to apply to gas streams other than those emitted directly to the atmosphere without further processing.

2.0 INTERFERENCES

Beryllium emissions are isokinetically sampled from the source, and the collected sample is digested and analyzed by atomic absorption spectrophotometry.

3.0 INTERFERENCES

Not specified in method.

4.0 METHOD TARGET COMPOUNDS

beryllium compounds

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

beryllium compounds

EPA METHOD 106

Determination of Vinyl Chloride from Stationary Sources

REFERENCE:

U.S. Environmental Protection Agency. Code of Federal Regulations. Title 40 CFR, Part 61, Appendix B. Washington, D.C. Office of the Federal Register, July 1, 1987.

1.0 SCOPE AND APPLICATION

EPA Method 106 is applicable to the measurement of vinyl chloride in stack gases from ethylene dichloride, vinyl chloride, and polyvinyl chloride manufacturing processes. The method does not measure vinyl chloride contained in particulate matter.

2.0 SUMMARY OF METHOD

An integrated bag sample of stack gas containing vinyl chloride is subjected to GC analysis using a flame ionization detector.

3.0 INTERFERENCES

The chromatographic columns and the corresponding operating parameters described in Method 106 normally provide an adequate resolution of vinyl chloride. However, resolution interferences may be encountered on some sources.

4.0 METHOD TARGET COMPOUNDS

vinyl chloride

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

vinyl chloride

EPA METHOD 114

Test Methods for Monitoring Radionuclide Emissions from Stationary Sources

REFERENCE:

Standards of Performance for New Stationary Sources. Compilation. U. S. Environmental Protection Agency, EPA-340/1-77-015.

1.0 SCOPE AND APPLICATION

EPA Method 114 contains guidance on continuous stack sampling for radionuclides and radiochemical methods used to analyze the sample. Radionuclides differ in the chemical and physical forms, half-lives, and type of radiation emitted. The appropriate type of sample extraction, collection, and analysis for an individual radionuclide depends on many interrelated factors, including the mixture of other radionuclides present. Therefore the procedure for radionuclide sampling and analysis described in Method 114 is actually a series of methods based on principles of measurement that provides the user with flexibility to choose the combination of sampling and analysis schemes most applicable to the effluent stream measured.

The analysis methods described in Method 114 are for commonly found radionuclides that have the greatest potential for public harm. The analyses are grouped according to the type of radiation emitted: alpha, beta, or gamma.

2.0 SUMMARY OF METHOD

2.1 Particulate Sampling

Continuous sampling can be performed according to EPA Method 5 or SW-846 Method 0020 to isokinetically sample radionuclides present as particulate matter. A probe is equipped with a filter that has a high efficiency for submicrometer particles. Additional guidance can be found in the American National Standards Institutes' "Guide to Sampling Airborne Radioactive Materials at Nuclear Facilities" (1969).

2.2 Gaseous Sampling

Radionuclides of hydrogen, oxygen, carbon, nitrogen, the noble gases, and in some cases iodine, will be in the gaseous form. Radionuclides of these elements will require direct flow into a counter or suitable bubblers to collect the radionuclides. The following are suggested media for gaseous sample collection:

<u>Radionuclide</u>	<u>Medium</u>
tritium	silica gel, molecular sieves, ethylene glycol, water
iodine	charcoal, metal zeolites, caustic solution
argon, krypton, xenon	charcoal or metal zeolites
oxygen, carbon, nitrogen, radon	caustic solution

2.3 Analysis

2.3.1 Alpha Analysis

The element of interest is separated from the sample matrix by precipitation, ion exchange, or solvent extraction; or by carriers using electrodeposition or coprecipitation. The alpha energy is measured by alpha spectrometry or an alpha counter. Particulate samples can be analyzed from the surface of the filter directly by alpha spectrometry or an alpha counter.

2.3.1.1 Uranium Analysis. Uranium is dissolved and extracted into hexane. The extract can be analyzed colorimetrically by adding dibenzoylmethane, or fluorometrically after fusion with sodium fluoride-lithium fluoride.

2.3.1.2 Radon-222. Radon in the gaseous form can be detected continuously using a calibrated scintillation cell

2.3.2. Beta Analysis

Gaseous samples can be continuously analyzed by flow through a ionization chamber or another beta detector such as a Geiger-Müller tube. In non-gaseous sample mixtures, the element of interest is separated from other radionuclides by precipitation, distillation, ion exchange, solvent extraction, or carriers. The extracted radionuclide is analyzed with a scintillation cell or a beta counter. Particulate samples can be analyzed directly from the filter with a beta counter when it is known that the sample contains only the radionuclide of interest.

2.3.3. Gamma Analysis

High resolution gamma spectroscopy can be used to directly measure gaseous, liquid, or particulate gamma-emitting radionuclides. Prior chemical separation is not usually necessary. For simple mixtures, low resolution gamma spectroscopy can be used. Single channel gamma spectrometry can be used when only one gamma-emitting radionuclide is present.

3.0 INTERFERENCES

Some analysis methods state that only one radionuclide can be present without interference in the analysis. Sufficient separation must occur to produce a pure sample from combined extracts and with a correction for chemical yield.

4.0 METHOD TARGET COMPOUNDS

- carbon*
- hydrogen*
- iodine*
- nitrogen*
- noble gases (including argon)
- oxygen*
- polonium-210
- radon-222
- tritium*
- uranium

* Usually gaseous

NOTE: Method target compounds are not limited to those listed above.

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

radionuclides

EPA METHODS 515/615

Determination of Chlorinated Herbicides in Drinking Water (Method 515) Determination of Chlorinated Herbicides in Industrial and Municipal Wastewater (Method 615)

REFERENCES:

- Method 515 - Supplement to "Method for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water." EPA EMSL. September 1986.
- Method 615 - Pressley, Thomas A., and Longbottom, James E., EPA EMSL. "The Determination of Chlorinated Herbicides in Industrial and Municipal Wastewater." January 1982.

1.0 SCOPE AND APPLICATION

EPA Methods 515 and 615 are used to determine certain chlorinated acid herbicides in drinking water (Method 515) and wastewater (Method 615). Chlorinated herbicides in air will be distributed between particulate and gas phase, depending upon temperature.

2.0 SUMMARY OF METHOD

Methods 515 and 615 need to be modified to allow extraction of solid sorbent used for air sampling. The original methods require acidifying approximately 1 L of sample. The acid herbicides and their esters and salts are then extracted with ethyl ether using a separatory funnel. The esters are hydrolyzed and converted to acid salts with potassium hydroxide solution. The aqueous phase containing the acid salts is then

solvent-washed to remove extraneous organic material. After acidification, the acids are extracted into organic phase and the sample volume reduced to 5 mL in methyl t-butyl ether (MTBE) with a K-D concentrator. The acids are converted to their methyl ester using diazomethane as the derivatizing agent. Excess reagent is removed and the esters are determined by electron capture gas chromatography.

3.0 INTERFERENCES

Interferences may be caused by contaminants in solvents, reagents, and glassware. Therefore, care must be taken during sample preparation to ensure minimal interferences.

The acid forms of the herbicides are strong organic acids that react readily with alkaline substances and can be lost during analysis. Glassware and glass wool must be acid-rinsed, and the sodium sulfate must be acidified prior to use to avoid this possibility.

Organic acids and phenols, especially chlorinated compounds, cause the most direct interference with the analysis. Alkaline hydrolysis and subsequent extraction of the basic solution remove many chlorinated hydrocarbons and phthalate esters that might otherwise interfere with the electron capture analysis.

4.0 METHOD TARGET COMPOUNDS

2,4-D

2,4-DB

dalapon

dicamba

dichlorprop*

dinoseb

MCPA*

MCPP*

pentachlorophenol (PCP)

picloram

2,4,5-T

2,4,5-TP (silvex)

* Method 615 only

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

2,4-D esters and salts

pentachlorophenol

EPA METHOD 531

Measurement of N-Methyl Carbamoyloximes and N-Methyl Carbamates in Drinking Water by Direct Aqueous Injection HPLC with Post-Column Derivatization

REFERENCE:

U.S. Environmental Protection Agency, EPA/600/485/054

1.0 SCOPE AND APPLICATION

EPA Method 531 is used to identify and measure N-methylcarbamoyloximes and N-methyl carbamates in finished drinking water, raw source water, or drinking water at any treatment stage.

2.0 SUMMARY OF METHOD

Air samples are collected using EPA sampling Method 0010. The solid sorbents used in Method 0010 are extracted with methylene chloride. Extensive modification of chromatographic conditions of Method 531 will be required to perform analysis of air samples.

In Method 531, a high performance liquid chromatographic (HPLC) system capable of injecting 200 to 400 μL aliquots and performing binary linear gradients at a constant flow rate is used for sample analysis. The recommended column is a 10 cm long x 8 mm ID radially compressed HPLC column packed with 10 μm μ -Bondapak C_{18} or equivalent. Use of a guard column is also recommended. A post-column reactor capable of mixing reagents into the mobile phase is needed. The fluorescence detector should be capable of excitation at 230 nm and detecting emission energies greater than

419 nm. Fluorometers should have dispersive optics for excitation and be able to utilize either filters or dispersive optics at the emission detector.

The water sample is filtered and a 400- μ L aliquot is injected into a reverse phase HPLC column. Separation of the analytes is achieved using gradient elution chromatography. After elution from the HPLC column, the analytes are hydrolyzed with 0.05N sodium hydroxide at 95°C. The methyl amine formed during hydrolysis is reacted with *o*-phthalaldehydes to form a highly fluorescent derivative which is detected using a fluorescence detector.

The analytes are identified by comparing the retention times of the unknowns to the retention times of standards, and the concentration of individual compounds in the sample is determined.

3.0 INTERFERENCES

Any matrix interferences that will interfere with the chromatography are interferences for the method. Matrix interference that will produce saturation of the chromatographic system will interfere with the analysis of target compounds even if the fluorescence detector will resolve the compounds.

4.0 METHOD TARGET COMPOUNDS

- aldicarb
- aldicarb sulfone
- aldicarb sulfoxide
- carbaryl
- carbofuran
- 3-hydroxycarbofuran

methomyl

oxamyl

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

carbaryl

dimethyl carbamoyl chloride

EPA METHOD 632

Determination of Carbofuran, Fluometuron, Methomyl, and Oxamyl in Wastewater

REFERENCE:

U. S. Environmental Protection Agency, EMSL, Physical and Chemical Methods Branch.
November, 1985.

1.0 SCOPE AND APPLICATION

EPA Method 632 is a high performance liquid chromatographic (HPLC) method used to determine certain carbamate and urea pesticides in industrial and municipal wastewater discharges.

2.0 SUMMARY OF METHOD

Air samples may be obtained using EPA Method 0010, and the solid sorbent extracted with methylene chloride.

When Method 632 is applied to wastewater, a measured volume of sample (about 1 L) is solvent-extracted with methylene chloride using a separatory funnel. The methylene chloride extract is dried and concentrated to a volume of 10 mL or less. HPLC conditions are described that permit the separation and measurement of the compounds in the extract.

The HPLC analytical system should include high pressure syringes or sample injection loop, analytical columns, ultraviolet (UV) detector and strip chart recorder. A guard column is recommended for all applications. The recommended analytical column

is a 30 cm long x 4 mm ID stainless steel packed with μ -Bondapak C₁₈ (10 μ m) or equivalent with Whatman Co. PELL ODS (30 - 38 μ m) guard column, 7 cm long x 4 mm ID. The UV detector should be capable of monitoring at 254 nm and 280 nm.

The HPLC system may be calibrated using either the external or internal standard technique. The standards and extracts must be in the solvent (acetonitrile or methanol) compatible with the mobile phase.

The sample extract is injected (around 10 μ L), the resulting peak size in area or peak height units is recorded, and the concentration of individual compounds in the sample is determined.

3.0 INTERFERENCES

Matrix interferences may be caused by contaminants that are coextracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature and diversity of the industrial complex or municipality sampled.

4.0 METHOD TARGET COMPOUNDS

aminocarb
barban
carbaryl
carbofuran
chlorpropham
diuron
fenuron
fenuron-TCA

fluometuron
linuron
methiocarb
methomyl
mexacarbate
monuron
monuron-TCA
neburon
oxamyl
propham
propoxur
siduron
swep

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

caprolactam
ethylene thiourea
ethyl carbamate
propoxur

EPA METHOD 680

Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Mass Spectrometry

REFERENCE:

U. S. Environmental Protection Agency, EMSL, Physical and Chemical Methods Branch.
November, 1985.

1.0 SCOPE AND APPLICATION

EPA Method 680 provides procedures for mass spectrometric determination of polychlorinated biphenyls (PCBs) and pesticides in water, soil, or sediment. These compounds in air will be mostly associated with particulate, although some can exist in the gas phase if the source temperature is high enough and the compound is sufficiently stable. A modification of the method in order to analyze air samples is possible.

2.0 SUMMARY OF METHOD

Sample preparation consists of placing a 1-L water sample in a separatory funnel, extracting with methylene chloride, followed by hexane exchange. Method 680 must be modified, however, to allow for extraction of solid sorbent used for air sampling. Sample extract components are then separated with capillary column gas chromatography (GC) and identified and measured with low resolution electron ionization mass spectrometry. Two surrogate compounds and two internal standards are added to each sample. Because of the multi-compound characteristics of PCBs, they are identified and measured as isomer groups. A concentration is measured for each PCB isomer group, and total PCB concentration in each sample extract is obtained by summing isomer group concentrations.

3.0 INTERFERENCES

Interferences may be caused by contaminants in solvents, reagents, and glassware. Therefore, care must be taken in sample preparation to assure minimal interferences.

With both pesticides and PCBs, interferences can be caused by the presence of much greater quantities of other sample components that overload the capillary column. Therefore, additional sample cleanup procedures may be necessary to eliminate these interferences. Capillary column GC retention times and the compound-specific characteristics of mass spectra eliminate many of the interferences that formerly were of concern with pesticide/PCB determinations with electron capture detection. The approach and identification criteria used in this method eliminate interference by most chlorinated compounds other than other PCBs. With the isomer groups approach, coeluting PCBs that contain the same number of chlorines are identified and measured together. Therefore, coeluting PCBs are a problem only if they contain a different number of chlorine atoms.

4.0 METHOD TARGET COMPOUNDS

- aldrin
- alpha-BHC
- beta-BHC
- chlordane
- delta-BHC
- 4,4'-DDD
- 4,4'-DDE
- 4,4'-DDT
- decachlorobiphenyl
- dichlorobiphenyls

dieldrin
endosulfan I
endosulfan II
endosulfan sulfate
endrin
endrin aldehyde
heptachlor
heptachlor epoxide
heptachlorobiphenyls
hexachlorobiphenyls
lindane
methoxychlor
monochlorobiphenyls
nonachlorobiphenyls
octachlorobiphenyls
pentachlorobiphenyls
tetrachlorobiphenyls
trichlorobiphenyls

5.0 APPLICABLE CAA AMENDMENTS POLLUTANTS

chlordane
4,4'-DDE
polychlorinated biphenyls
heptachlor
lindane
methoxychlor
toxaphene

SECTION 4

SAMPLING AND ANALYSIS PROCEDURES COSTS

The cost of performing stack sampling and analysis for toxic organic compounds will vary considerably depending on the degree of validation of the method. For compounds where a validated method is available the cost of collecting a sample and determining the concentration of a specific compound is provided in Table 4. In most cases duplicate or triplicate samples should be collected. For compounds assigned to sampling/analytical methods where a degree of success with sampling and analysis has been demonstrated but the methodology is not validated through spiking sampling trains and analysis of the components in the sample matrix of interest, field sampling must be preceded by laboratory spiking and analysis of samples taken from identical or similar matrices. Where no method has been investigated (i.e., methods were chosen using physical properties alone or previous experience with similar analytes), laboratory conditions for analysis of samples must be evaluated, analytical precision and recovery must be determined, and common interferences must be investigated (e.g., H_2O , CO_2 , acids, laboratory solvents, hydrocarbons, coeluting compounds for chromatographic methods). Once analytical conditions have been determined, a full validation should be performed using the EPA protocol for method validation. A full method development and validation for a single analyte can cost more than \$20,000. Method validation for multiple analytes can frequently be performed efficiently at minimal additional cost.

The use of the cost figures presented in Table 4 assumes that the data quality objectives for the program where sampling/analysis is required do not require data to be generated that will be used for regulatory purposes. Furthermore, when the most generic methods available are applied to determine the broadest range of compounds simultaneously in a screening approach, significant compromises of individual compound precision and accuracy may be encountered.

Table 4
Estimated Sampling and Analytical Costs

Source Methods	Average Cost Single Sample	Average Cost Triplicate Samples
Method 0010 Semivolatile Organics	\$ 7,460	\$ 22,380
Method 0011 Aldehydes/Ketones	\$ 6,780	\$ 20,340
Method 0030 Volatile Organics	\$ 6,080	\$ 18,240
Method 0012 Metals	\$ 8,180	\$ 24,540
Method 18 GC/General	\$ 5,660	\$ 18,240
Method 23 PCDD/PCDF	\$ 12,140	\$ 36,420
CARB 427 Asbestos	\$ 7,200	\$ 21,600
Method 26 Halo-acids	\$ 5,170	\$ 15,510
Method 13/14 HF	\$ 5,170	\$ 15,510
Method 15 H ₂ S and CS ₂	\$ 6,430	\$ 19,290
CARB 429 PAH/POM	\$ 6,640	\$ 19,920
Radionuclides/Particulate	\$ 6,780	\$ 20,340
Radionuclides/Part. + Gases	\$ 8,180	\$ 24,540
TO-01 Aromatic VOC	\$ 3,240	\$ 9,720
TO-02 Halocarbon VOC	\$ 3,240	\$ 9,720
TO-04 PUF/Biphenyls	\$ 5,330	\$ 15,990
TO-05 Aldehydes	\$ 3,570	\$ 10,710
TO-06 Phosgene	\$ 3,460	\$ 10,380
TO-07 N-NitrosoDPA	\$ 3,060	\$ 9,180
TO-08 Phenols	\$ 2,800	\$ 8,400

Table 4
(Continued)

Source Methods	Average Cost Single Sample	Average Cost Triplicate Samples
TO-09 PCDD&PCDF-HRMS	\$ 7,090	\$ 21,270
TO-10 PUF/Pesticides	\$ 4,670	\$ 14,010
TO-11 Aldehydes	\$ 2,940	\$ 8,820
TO-13 PUF-XAD/PAH	\$ 4,370	\$ 13,110
TO-14 VOC Canisters	\$ 3,490	\$ 10,470
NIOSH 2515 Diazomethane	\$ 3,240	\$ 9,720

Assumptions:

Standard stack sampling is occurring concurrently at the site.

Audit personnel are already at the site for criteria pollutants.

Travel to or from the site by sampling personnel is not included in costs.

Only one sample of a given type will be taken.

Efficiencies are possible when multiple samples are taken per episode.

ODC costs include one night lodging and two days per diem.

Each train requires only one person in the field for sampling.

Laboratory analysis includes sample preparation, analysis, validation of results.

Laboratory results are forwarded to the project team in tabular format.

Reporting costs involve inclusion of laboratory results into a larger project report.

As an example, the cost to add screening for semivolatile organic compounds should encompass: test plan revisions, presampling sampling train preparation, onsite train setup, actual sampling, sample recovery from the train, laboratory analysis which may require specialized techniques to include non-routine analytes, data interpretation and reporting. The cost to perform this addition to an existing program is on the order of \$30,000. This cost does not include any in-stack spiking or method validation procedures, nor does the cost include any laboratory presampling/preanalysis method development.

APPENDIX A

**PHYSICAL PROPERTIES OF PROPOSED
CLEAN AIR ACT COMPOUNDS/CHEMICALS**

A-1

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
75070	Acetaldehyde	21	-125	900.710
60355	Acetamide	222	79-81	1.00
75058	Acetonitrile	82	-48	86.8
98862	Acetophenone	202	19-20	0.298
53963	2-Acetylaminofluorene		194	
107028	Acrolein	53	-87	423.130
79061	Acrylamide	125/25mm	84-86	0.012
79107	Acrylic acid	139	13	5.470
107131	Acrylonitrile	77	-83	106.300
107051	Allyl chloride	44-46	-134.5	357.270
92671	4-Aminobiphenyl	191/15mm	52-54	
62533	Aniline	184	-6	0.367
90040	o-Anisidine	225	5-6	
71432	Benzene	80	5	95.038
92875	Benzidine	400/740mm	125	0.00001
98077	Benzotrichloride	219-223	-7	0.200
100447	Benzyl chloride	177-181	-43	1.210
92524	Biphenyl	255	69-72	0.029
117817	Bis(2-ethylhexyl) phthalate	384	-50	9.8 X 10-8
542881	Bis(chloromethyl) ether	106	-41.5	30.000
75252	Bromoform	150-151	8.3	5.600
106990	1,3-Butadiene	-4.5	-109	2100.169
105602	Caprolactam	268	70-72	0.700

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
133062	Captan		158-164	<1,2.10-9 mbar @20° C
63252	Carbaryl		145	0.00004
75150	Carbon disulfide	46	-112	360.227
56235	Carbon tetrachloride	77	-23	115.246
463581	Carbonyl sulfide	-50	-138	
120809	Catechol	245	104-106	710.000
133904	Chloramben		200.5	0.002
57749	Chlordane	175	107.9	0.00001
79118	Chloroacetic acid	189	62-64	1.000
532274	2-Chloroacetophenone	244-245	54-56	0.012
108907	Chlorobenzene	132	-45	11.967
510156	Chlorobenzilate	147	36.65	
67663	Chloroform	60.5-61.5	-63	194.071
107302	Chloromethyl methyl ether	55-57	-103.5	224.000
126998	Chloroprene	59.4	-130	178.000
95487	o-Cresol	191	32-34	0.230
108394	m-Cresol	203	8-10	0.167
106445	p-Cresol	202	32-34	0.089
1319773	Cresylic acid	197	30.00	0.300
98828	Cumene	152-154	-96	4.871
94757	2,4-D salts and esters	160/.4mm	138	<10-7 mbar @20° C
3547044	DDE		88-90	

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
334883	Diazomethane	-23	-145 (fp)	
132649	Dibenzofurans			
96128	1,2-Dibromo-3-chloropropane	196	5.0	0.800
84742	Dibutyl phthalate	340	-35	0.00016
106467	1,4-Dichlorobenzene(p)	173	54-56	0.6
91941	3,3'-Dichlorobenzidine		16°	
111444	Dichloroethyl ether	65-67/15 mm	-47	0.507
542756	1,3-Dichloropropene	105-106/730mm	np	43.000
62737	Dichlorvos	117/10mm		2.9E3 mb @20° C
111422	Diethanolamine	268.4	27-30	0.01
121697	N,N-Diethylaniline	217	-38	0.003
64675	Diethyl sulfate	208	-24	0.190
119904	3,3'-Dimethoxybenzidine		132-133	0.00000029
60117	Dimethylaminoazobenzene		111	
119937	3,3'-Dimethylbenzidine		129-131	
79447	Dimethyl carbamoyl chloride	165	-33.0	
68122	Dimethyl formamide	153	-61	3.995
57147	1,1-Dimethylhydrazine	62-64/753mm	-58	156.823
131113	Dimethyl phthalate	282	2	<0.01
77781	Dimethyl sulfate	188	-32	0.100
534521	4,6-Dinitro-o-cresol and salts	312	87.5	0.0051
51285	2,4-Dinitrophenol	106-108	114.5	53.8
121142	2,4-Dinitrotoluene	300	67-70	0.005

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
123911	1,4-Dioxane	100-102	11.8	37.308
122667	1,2-Diphenylhydrazine	220	123-126	0.00005230
106898	Epichlorohydrin	115-117	-57	17.002
106887	1,2-Epoxybutane	63	-50 (fp)	5.8 psia (Reid)
140885	Ethyl acrylate	99	-71	40.000
100414	Ethylbenzene	136	-95	9.909
51796	Ethyl carbamate	180	49	0.360
75003	Ethyl chloride	12	-136	1198.601
106934	Ethylene dibromide	131-132	9-10	11.814
107062	Ethylene dichloride	83	-35	78.107
107211	Ethylene glycol	196-198	-13	0.089
151564	Ethylene imine	56.6	-71.5	160.0
75218	Ethylene oxide	11	-111	511.492
96457	Ethylene thiourea		197-200	
75343	Ethylidene dichloride	57	-97	80.000
50000	Formaldehyde	-20	-92	2.200
	Glycol ethers			
76448	Heptachlor	145	95.5	0.0003 mm Hg @ 25° C
118741	Hexachlorobenzene	323-326	227-229	1.000
87683	Hexachlorobutadiene	210-220	-22 to -19	0.1
77474	Hexachlorocyclopentadiene	239	-9	0.081
67721	Hexachloroethane	186	190-195	0.081
822060	Hexamethylene-1,6-diisocyanate	225	-67	0.0500

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20°C)
680319	Hexamethylphosphoramide	230-232	7	.0300
110543	Hexane	69	-95	150.00
302012	Hydrazine	113.5	2	14.4
123319	Hydroquinone	285	172-175	
78591	Isophorone	213-214	-8	0.439
58899	Lindane	323.4	112.5	1,2.10-5mb @20C
108316	Maleic anhydride	200	54-56	0.000
67561	Methanol	64.6	-98	124.883
72435	Methoxychlor		89	very low
74839	Methyl bromide	4	-94	1591.890
74873	Methyl chloride	-24.2	-97	3830.000
71556	Methyl chloroform	74-76	-50	133.353
78933	Methyl ethyl ketone	80	-87	90.181
60344	Methyl hydrazine	87	-52.4	49.6
74884	Methyl iodide	41-43	-64	400.00
108101	Methyl isobutyl ketone	117-118	-80	19.283
624839	Methyl isocyanate	37-39	-17	348.0
30626	Methyl methacrylate	100	-48	36.333
1634044	Methyl tert-butyl ether	53-56	-115	245.0
101144	4,4-Methylene bis(2-chloroaniline)		99-107	
75092	Methylene chloride	39.8-40	-97	429.243
101688	Methylene diphenyl diisocyanate		37	.001
101779	4,4'-Methylenedianiline	265	89-91	

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
91203	Naphthalene	217.7	80-82	0.087
98953	Nitrobenzene	210-211	5-6	0.259
92933	4-Nitrobiphenyl	340	112-114	
100027	4-Nitrophenol	270	113-115	0.380
79469	2-Nitropropane	120	-93	20.120
684935	N-Nitroso-N-methylurea		123-124	
62759	N-Nitrosodimethylamine	153/774mm		2.7
59892	N-Nitrosomorpholine	139-140/25mm	29	
56382	Parathion	375	6	0.003
82688	Pentachloronitrobenzene	328	144	0.13
87865	Pentachlorophenol	309.5	190	~0.005
108952	Phenol	182	40-42	0.352
106503	p-Phenylenediamine	267	143-145	0.005
75445	Phosgene	8.2/760mm	-118	1418
85449	Phthalic anhydride	284	131-134	0.002
1336363	Polychlorinated biphenyls			
1120714	1,3-Propane sultone	180	31-33	
57578	beta-Propiolactone	162	-33	3.4
123386	Propionaldehyde	46-50	-81	318.730
114261	Propoxur		32.19	< 10-5 mbar @ 20° C
78875	Propylene dichloride	95-96	-100	40.000
75569	Propylene oxide	34	-112	539.319
75558	1,2-Propylenimine	66-67	-65	112.0

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20 C)
91255	Quinoline	237.7	-15	Not available
106514	Quinone		113-115	0.1000
100425	Styrene	145-146	-31	6.591
96093	Styrene oxide	194	-37	0.300
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin			
79345	1,1,2,2-Tetrachloroethane	147	-43	4.339
127184	Tetrachloroethylene	121	-22	18.090
108883	Toluene	111	-93	28.402
95807	2,4-Toluene diamine	283-285	97-99	0.001
584849	2,4-Toluene diisocyanate	251/760mm	20	0.1
95534	o-Toluidine	199-200	-28	0.242
9001352	Toxaphene		77.5	0.40
120821	1,2,4-Trichlorobenzene	214	16	0.180
79005	1,1,2-Trichloroethane	110-115	-37	21.573
79016	Trichloroethylene	86.9	-84.8	69.037
95954	2,4,5-Trichlorophenol	248/740mm	67-69	0.05
88062	2,4,6-Trichlorophenol	246	64-66	0.300
121448	Triethylamine	88.8	-115	67.970
1582098	Trifluralin	139-149	49	0
540841	2,2,4-Trimethylpentane	98-99	-107	40.600
108054	Vinyl acetate	72-73	-93	114.730
593602	Vinyl bromide	16/750mm	-139	1058.3
75014	Vinyl chloride	-13.4	-153.8	2660.725

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 20° C)
75354	Vinylidene chloride	30-32	-122	601.198
1330207	Xylenes (isomers and mixture)			
95476	o-Xylene	143-145	-25 to -23	6.604
108383	m-Xylene	138-139	-47.9 (Fp)	11.721
106423	p-Xylene	138	12-13	8.747
	Antimony compounds			
1332214	Asbestos			
	Arsenic compounds			
	Beryllium compounds			
	Cadmium compounds			
156627	Calcium cyanamide		1340	
7782505	Chlorine	-34.1	-101	4800 @ 20C
	Chromium compounds			
	Cobalt compounds			
	Coke oven emissions			
	Cyanide compounds			
7647010	Hydrochloric acid	-85.1/760mm	-114.2	
7664393	Hydrogen fluoride	19.5	-83.6	
	Lead compounds			
	Manganese compounds			
	Mercury compounds			
	Mineral fibers			
	Nickel compounds			

**APPENDIX A: PHYSICAL PROPERTIES OF PROPOSED CLEAN AIR ACT
COMPOUNDS/CHEMICALS**

CAS #	Compound/Chemical	Boiling Point (celsius)	Melting Point (celsius)	Vapor Pressure (mm @ 25 C)
7803512	Phosphine	-87.7	-133	
7723140	Phosphorus			
	Polycyclic organic matter			
	Radionuclides			
	Selenium compounds			
7550450	Titanium tetrachloride	136.4	-24.1	

APPENDIX B

NIOSH AND OSHA AMBIENT AIR METHODS

B-i

Methods from NIOSH and OSHA are single-analyte methods, focused on sampling in a workplace environment, usually at ambient or nearly ambient levels. Many of the methods may not be appropriate at all for stationary sources, other methods may require extensive modification. All NIOSH/OSHA methods would require validation for stationary source applications. In the course of the literature review for this program, NIOSH/OSHA methods were reviewed. Methods applicable to Clean Air Act analytes are listed by number, according to analytes, for information only.

National Institute for Occupational Safety and Health. NIOSH Manual of Analytical Methods. Part 1, NIOSH Monitoring Methods, Volume 1. U.S. Department of Health, Education, and Welfare, Cincinnati, OH. Revised 1985.

Workplace inorganic methods Source:

OSHA Analytical Methods Manual published by ACGIH

(Cat. No. 0788), Cincinnati, OH 45211

Phone Number: 513-661-7881

Methods 1-80 Source: Cat. No. 4542

Methods 55-80 Source: Cat. No. 4544

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS

Compounds	NIOSH Method Number
Acetaldehyde	3507
Acetonitrile	1606
Acrylonitrile	1604
Allyl chloride	1000
Aniline	2002
Asbestos (bulk)	9001
Benzene	1501
Benzidine	5013/5509
Benzyl chloride	1003
Beryllium compounds	7102
Bromoform	1003
1,3-Butadiene	1024
Cadmium compounds	7048/7200
Carbon disulfide	1600
Carbon tetrachloride	1003
Chlordane	5510
Chlorobenzene	1003
Chloroform	1003
Chloroprene	1002

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS

Compounds	NIOSH Method Number
Chromium compounds	7200/7024
Cobalt compounds	7027
Cumene	1501
Cyanide compounds	7904
Dibutyl phthalate	5020
3,3'-Dichlorobenzidine	5509
Dimethyl formamide	2004
Epichlorohydrin	1010
Ethylbenzene	1501
Ethylene dibromide	1008
Ethylene dichloride	1003
Ethylene glycol	5500
Ethylene oxide	1614/1607
Ethylene thiourea	5011
Formaldehyde	3501/2541/3500
Hexachloroethane	1003
Hydrazine	3503
Hydroquinone	5004
Lead compounds	7082

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS	
Compounds	NIOSH Method Number
Manganese compounds	7200
Methanol	2000
Methyl chloride	1001
Methyl chloroform	1003
Methyl iodide	1014
Methylene chloride	1005
4,4'-Methylenedianiline	5029
Naphthalene	1501
Nickel compounds	7200
Nitrobenzene	2005
N,N-Diethylaniline	2002
o-Anisidine	5013
o-Toluidine	2002/5013
Pentachlorophenol	5512
Phenol	3502
Phosphine	7905
Propylene oxide	1612
Styrene	1501
1,1,2,2-Tetrachloroethane	1019

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS	
Compounds	NIOSH Method Number
Tetrachloroethylene	1003
Toluene	1501/4000
2,4-Toluene diamine	5516
1,2,4-Trichlorobenzene	5517
1,1,2-Trichloroethane	1003
Trichloroethylene	1022
Vinyl bromide	1009
Vinyl chloride	1007
Vinylidene chloride	1015
Xylenes	1501

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS

Compounds	OSHA Method Number
Acetaldehyde	68
Acrolein	52
Acrylamide	21
Acrylic acid	28
Acrylonitrile	37
Benzene	12
Benzidine	65
Bis(chloromethyl)ether	10
1,3-Butadiene	56
Carbaryl	63
Chlordane	67
Chloroform	5
Chloromethyl methyl ether	10
Coke oven emissions	58
Cresylic acid	32
3,3'-Dichlorobenzidine	65
Dichlorvos	62
2,4-Dinitrotoluene	44
Ethylene dibromide	2

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS	
Compounds	OSHA Method Number
Ethylene dichloride	3
Ethylene oxide	50
Formaldehyde	52
Hexamethylene-1,6-diisocyanate	42
Hydrazine	20
Maleic anhydride	25
Methyl isocyanate	54
Methylene chloride	80
4,4'-Methylenedianiline	57
Methylene diphenyl diisocyanate	47
Naphthalene	35
2-Nitropropane	46
N-Nitrosodimethylamine	27
N-Nitrosomorpholine	27
o-, m-, and p-Cresols	32
o-Toluidine	73
Parathion	62
Pentachlorophenol	39
Phenol	32

APPENDIX B. NIOSH AND OSHA AMBIENT AIR METHODS

Compounds	OSHA Method Number
Phosgene	61
Styrene	9
2,4-Toluene diamine	65
2,4-Toluene diisocyanate	42
1,1,2-Trichloroethane	11
Vinyl acetate	51
Vinyl bromide	8
Vinyl chloride	75
Vinylidene chloride	19
Arsenic compounds	ID-105
Chlorine	ID-101
Chromium compounds	ID-103
Cyanide compounds	ID-120
Mercury compounds	ID-121
Phosphorus	ID-180*

APPENDIX C

CLEAN AIR ACT LIST CHEMICALS

DATABASE COMPILED BY SOUTHERN RESEARCH INSTITUTE

Problem POHC Reference Directory, EPA 600/3-90/094, Effective Date: January 1991.

RECORD NUMBER: 1 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Acetaldehyde

CAS REGISTRY NO: 75-07-0

FORMULA: C2-H4-O

MOLECULAR WEIGHT: 44.05

COMPOUND CLASS: Aldehyde

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 20.8

MELTING POINT, CELSIUS: -121

FLASH POINT, CELSIUS: -38.00

SOLUBILITY, IN WATER: VERY SOL

HEAT OF COMBUSTION, KCAL/MOLE: 278.77

COMBUSTION RANKING: 100

TOXICITY DATA:

SAMPLING METHOD: SW-846 Draft Method No. 0011 (DNPH Impinger)

ANALYSIS METHOD:

SW-846 Draft Method No. 8315 (Extraction-HPLC of DNPH derivative)

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration," Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Toxic

DESCRIPTION OF PROBLEMS:

Reactive during sampling and analysis. Acetaldehyde is water soluble. Sampled by derivatizing with 2,4-dinitrophenylhydrazine.

Purge efficiencies from vost tubes have been evaluated and found to be satisfactory with modified conditions. See "Development of VOST Sample Analysis Protocol for Water-Soluble Volatile POHCs And PICs" (EPA-600/8-87-008, February 1987)

SOLUTIONS:

Derivatized with 2,4-dinitrophenylhydrazine.

RECORD NUMBER:

2

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Acetamide
Ethanamide
Acetic acid amine

CAS REGISTRY NO: 60-35-5

FORMULA: C2-H5-N-O

MOLECULAR WEIGHT: 59.07

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 221.2

MELTING POINT, CELSIUS: 80

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 975 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen. Mild skin and eye irritant.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water Soluble

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 3

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: 2-Acetamidofluorene
2-Acetylaminofluorene

CAS REGISTRY NO: 53-96-3

FORMULA: C15-H13-N-O

MOLECULAR WEIGHT: 223.29

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 192

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5) or alkaline impinger

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS) or ion chromatography

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): TOXIC

DESCRIPTION OF PROBLEMS:

Potent liver carcinogen

SOLUTIONS:

RECORD NUMBER: 4

DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Acetonitrile
Ethane nitrile

CAS REGISTRY NO: 75-05-8

FORMULA: C2-H3-N

MOLECULAR WEIGHT: 41.00

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 17

BOILING POINT, CELSIUS: 81.6

MELTING POINT, CELSIUS: -45

FLASH POINT, CELSIUS: 12.80

SOLUBILITY, IN WATER: VERY SOL

HEAT OF COMBUSTION, KCAL/MOLE: 302.40

COMBUSTION RANKING: 93

TOXICITY DATA: Poisonous; may cause skin irritation

SAMPLING METHOD: No reliable method as of 03-17-89

ANALYSIS METHOD:

No reliable method as of 03-17-89

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water soluble

DESCRIPTION OF PROBLEMS:

Infinitely soluble in water, and is likely to be present in the condensate trap of the sampling train and of the water trap in Method 5040. Therefore, acetonitrile cannot be analyzed by Method 5040. (See "Development of VOST Sample Analysis Protocol for Water-Soluble Volatile POHCs and PICs" EPA-600/8-87-008)

SOLUTIONS:

Acetonitrile should not be selected as a POHC until reliable methods of sampling and of analysis are demonstrated.

RECORD NUMBER:

5

DATE OF LATEST ENTRY:

09/25/90

COMPOUND:

Acetophenone

1-Phenyl ethanone

CAS REGISTRY NO: 98-86-2

FORMULA: C8-H8-O

MOLECULAR WEIGHT: 120.10

COMPOUND CLASS: Aromatic ketone

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 85

BOILING POINT, CELSIUS: 202

MELTING POINT, CELSIUS: 20.5

FLASH POINT, CELSIUS: 105.00

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 991.60

COMBUSTION RANKING: 31

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 6 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Acrolein
2-Propenal

CAS REGISTRY NO: 107-02-8

FORMULA: C3-H4-O

MOLECULAR WEIGHT: 56.06

COMPOUND CLASS: Aldehyde

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 106

BOILING POINT, CELSIUS: 52.5

MELTING POINT, CELSIUS: -88

FLASH POINT, CELSIUS: -18.00

SOLUBILITY, IN WATER: VERY SOL

HEAT OF COMBUSTION, KCAL/MOLE: 389.68

COMBUSTION RANKING: 85

TOXICITY DATA: Highly toxic; flammable liquid

SAMPLING METHOD: SW-846 No. 0011 (DNPH Impinger) or 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 8315 (HPLC) or 5040 or 5041 (Purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis
Hazardous

SPECIFIC PROBLEM TYPE(S): Water soluble
Toxic

DESCRIPTION OF PROBLEMS:

Soluble in water, and therefore likely to be present in the condensate trap of the sampling train.

A Validation study showed that even with modifications to improve recovery, less than 50% of acrolein is recovered from the VOST train. See "Development of VOST Protocol for Water-Soluble Volatile POHCs and PICs." (EPA-600/8-87-008 February 1987)

SOLUTIONS:

Method 0011 is preferred over VOST.

A longer purge time might give adequate recovery.

The extract from the condensate liquor should also be analyzed by extraction-GC/MS.

RECORD NUMBER: 7

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Acrylamide
2-Propenamide

CAS REGISTRY NO: 79-06-1

FORMULA: C3-H5-N-O

MOLECULAR WEIGHT: 71.08

COMPOUND CLASS: Amide

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 60

BOILING POINT, CELSIUS: 125 25

MELTING POINT, CELSIUS: 84

FLASH POINT, CELSIUS: 138

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 4.50

COMBUSTION RANKING: 127

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST) or 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040 (Purge (Purge & Trap GC/MS) or 8270 (Extraction)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water Soluble

DESCRIPTION OF PROBLEMS:

Water solubility may cause low recovery.

SOLUTIONS:

Both sampling methods are acceptable, but due to recovery problems, they must be validated. Be particularly careful during solvent concentration steps.

RECORD NUMBER: 8

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Acrylic acid

CAS REGISTRY NO: 79-10-7

FORMULA: C3-H4-O2

MOLECULAR WEIGHT: 72.06

COMPOUND CLASS: Organic acid

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 141

MELTING POINT, CELSIUS: 14

FLASH POINT, CELSIUS: 54

SOLUBILITY, IN WATER: Miscible

HEAT OF COMBUSTION, KCAL/MOLE: 327

COMBUSTION RANKING:

TOXICITY DATA: Intense skin irritant. Can cause death or permanent injury.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Toxic

DESCRIPTION OF PROBLEMS:

Emits highly toxic fumes upon heating. Polymerizes easily.

SOLUTIONS:

May need a coated sorbent to collect and inhibit polymerization. See "Acrylic acid - the development of an air sampling and analytical methodology for determining occupational exposure". AIHAJ 43, 499-504 (1982).

RECORD NUMBER: 9

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Acrylonitrile
2-Propenenitrile

CAS REGISTRY NO: 107-13-1

FORMULA: C₃H_{3.5}N

MOLECULAR WEIGHT: 53.06

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 20

BOILING POINT, CELSIUS: 77.7

MELTING POINT, CELSIUS: -82

FLASH POINT, CELSIUS: 0

SOLUBILITY, IN WATER: SOL 7.3%

HEAT OF COMBUSTION, KCAL/MOLE: 421.00

COMBUSTION RANKING: 78

TOXICITY DATA: Highly toxic cancer suspect agent

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis
Hazardous

SPECIFIC PROBLEM TYPE(S): Water soluble
Toxic

DESCRIPTION OF PROBLEMS:

Soluble in water, and therefore is likely to be present in the condensate trap of the sampling train.

Validation studies have shown that recoveries can be improved if special methodology is used. See "Development of VOST Protocol for Water-Soluble Volatile POHCs and PICs" (EPA-600/8-87-008 February 1987)

SOLUTIONS:

A longer purge time might be necessary for adequate recovery. Also the extract from the condensate liquor should be analyzed by extraction-GC/MS.

RECORD NUMBER: 10 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: 4-Aminobiphenyl
(1,1'-Biphenyl)-4-amine
4-Biphenylamine

CAS REGISTRY NO: 92-67-1

FORMULA: C12-H11-N

MOLECULAR WEIGHT: 169.20

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 51

BOILING POINT, CELSIUS: 191

MELTING POINT, CELSIUS: 53

FLASH POINT, CELSIUS: 110.00

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE: 1524.00

COMBUSTION RANKING: 16

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Samples are unstable at ambient temperature.

SOLUTIONS:

RECORD NUMBER: 11

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aniline
Benzeneamine

CAS REGISTRY NO: 62-53-3

FORMULA: C6-H7-N

MOLECULAR WEIGHT: 93.12

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 46

BOILING POINT, CELSIUS: 185

MELTING POINT, CELSIUS: -6

FLASH POINT, CELSIUS: 169.00

SOLUBILITY, IN WATER: SOL 33G/L

HEAT OF COMBUSTION, KCAL/MOLE: 811.70

COMBUSTION RANKING: 45

TOXICITY DATA: Highly toxic; cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent. May react during sampling or analysis. Recovery is poor with methylene chloride and must be validated before going to field.

SOLUTIONS:

Extracting XAD2 with other solvents, such as hexane, has been more effective than with methylene chloride.

RECORD NUMBER: 12

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: o-Anisidine

CAS REGISTRY NO: 90-04-0

FORMULA: C7-H9-N-O

MOLECULAR WEIGHT: 123.16

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 225

MELTING POINT, CELSIUS: 5.5

FLASH POINT, CELSIUS: 98

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

SOLUTIONS:

RECORD NUMBER: 13 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Antimony and compounds, N.O.S.
Antimony

CAS REGISTRY NO: 7440-36-0

FORMULA: Sb

MOLECULAR WEIGHT: 121.75

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 1380

MELTING POINT, CELSIUS: 630

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Toxic

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic Spectroscopy)

VALIDATION STATUS:

For evaluation of this method, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors". Paper 5C-1 presented at "International Conference on Municipal Waste Combustors", Hollywood, FL April, 1989.

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 14

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1016

CAS REGISTRY NO: 12674-11-2

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 323-356

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: >141

SOLUBILITY, IN WATER: 0.25 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at the correct level for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 15

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1221

CAS REGISTRY NO: 11104-28-2

FORMULA:

MOLECULAR WEIGHT: Ave. 192

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 290-325

MELTING POINT, CELSIUS: 1

FLASH POINT, CELSIUS: 141

SOLUBILITY, IN WATER: 0.59 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at the correct levels for positive ID. Pattern recognition is not acceptable after a combustion device or many other contron devices.

SOLUTIONS:

Use GC/MS

RECORD NUMBER: 16

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1232

CAS REGISTRY NO: 11141-16-5

FORMULA:

MOLECULAR WEIGHT: Ave. 221

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 290-325

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: 154

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-854 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction -GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at the correct level for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 17

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1242

CAS REGISTRY NO: 53469-21-9

FORMULA:

MOLECULAR WEIGHT: Ave. 261

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 325-366

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: 176-180

SOLUBILITY, IN WATER: 0.10 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at the correct levels for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 18

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1248

CAS REGISTRY NO: 12672-29-6

FORMULA:

MOLECULAR WEIGHT: Ave 288

COMPOUND CLASS: PCB

APPENDIX 8? N

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 340-375

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: 193-196

SOLUBILITY, IN WATER: 54ug/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at correct levels for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 19

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1254

CAS REGISTRY NO: 11097-69-1

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 365-390

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: >141

SOLUBILITY, IN WATER: 0.57 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): Multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at correct levels for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 20

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Aroclor 1260

CAS REGISTRY NO: 11096-82-5

FORMULA:

MOLECULAR WEIGHT: Ave 372

COMPOUND CLASS: PCB

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 385-420

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: >141

SOLUBILITY, IN WATER: 0.080 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analytical

SPECIFIC PROBLEM TYPE(S): multicomponent analyte

DESCRIPTION OF PROBLEMS:

ECD determination is by pattern recognition, so all components must be present at the correct levels for positive ID. Pattern recognition is not acceptable after a combustion device or many other control devices.

SOLUTIONS:

Use GC/MS.

RECORD NUMBER: 21 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Arsenic and compounds, N.O.S.
Arsenic

CAS REGISTRY NO: 7440-38-2

FORMULA: As

MOLECULAR WEIGHT: 74.92

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 613

MELTING POINT, CELSIUS: 817

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Highly toxic cancer suspect agent

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic spectroscopy)

VALIDATION STATUS:

For evaluation of this method, see "Measurement Methodology for Toxic Metals From Municipal Waste Combustors" Paper 5C-1 presented at "International Conference on Municipal Waste Combustors", Hollywood, FL, April, 1989.

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 22

DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Asbestos

CAS REGISTRY NO: 1332-21-4

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Asbestos is a generic term for a series of thermally stable silicates. They are not suitable compounds for test burns.

SOLUTIONS:

RECORD NUMBER:

23

DATE OF LATEST ENTRY: 12/13/90

COMPOUND: Benzene

CAS REGISTRY NO: 71-43-2

FORMULA: C6-H6

MOLECULAR WEIGHT: 78.11

COMPOUND CLASS: Aromatic hydrocarbon

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 3

BOILING POINT, CELSIUS: 80.1

MELTING POINT, CELSIUS: 5.5

FLASH POINT, CELSIUS: -11.00

SOLUBILITY, IN WATER: Sol

HEAT OF COMBUSTION, KCAL/MOLE: 780.96

COMBUSTION RANKING: 47

TOXICITY DATA: Cancer suspect agent; flammable liquid

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 or Draft No. 5041 (Therm. Desor./P and Trap-GC/MS)

VALIDATION STATUS:

The VOST method has been validated for this compound (see "Validation Studies of the Protocol for the VOST" JAPCA Vol. 37, No. 4. 388-394, 1987). (Also see "Recovery of POHCs and PICs from a VOST" EPA-600/7-86-025.)

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Blank

DESCRIPTION OF PROBLEMS:

Cancer suspect.

Blank problem with Tenax.

Benzene is a Common PIC. This may complicate interpretation of results, and make it difficult to achieve acceptable DRE with low waste feed concentrations.

SOLUTIONS:

Level of lab blank should be determined in advance. Calculations should be made based on waste feed concentration to determine if blank level will be a significant problem. Benzene should not be chosen as a POHC at very low waste feed levels because it is likely to make the blank or PIC problems significant.

RECORD NUMBER: 24 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Benzidine
[1,1'-Biphenyl]-4,4'-diamine

CAS REGISTRY NO: 92-87-5

FORMULA: C12-H12-N2

MOLECULAR WEIGHT: 184.24

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 60

BOILING POINT, CELSIUS: 400

MELTING POINT, CELSIUS: 125

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Sol 0.4g/L

HEAT OF COMBUSTION, KCAL/MOLE: 1560.90

COMBUSTION RANKING: 12

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS) or HPLC/UV

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Cancer suspect. Compound decomposes and may not survive sampling atmosphere.

SOLUTIONS:

Sampling and analysis method should be validated.

RECORD NUMBER:

25

DATE OF LATEST ENTRY:

09/25/90

COMPOUND:

Benzotrichloride
Trichloromethylbenzene

CAS REGISTRY NO: 98-07-7

FORMULA: C7-H5-(Cl)3

MOLECULAR WEIGHT: 195.47

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 195

BOILING POINT, CELSIUS: 221

MELTING POINT, CELSIUS: -5

FLASH POINT, CELSIUS: 97.00

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Highly toxic; cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

SOLUTIONS:

RECORD NUMBER:

26

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Benzyl chloride
Benzene, (chloromethyl)-

CAS REGISTRY NO: 100-44-7

FORMULA: C7-H7-(Cl)

MOLECULAR WEIGHT: 126.59

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 127

BOILING POINT, CELSIUS: 179.3

MELTING POINT, CELSIUS: -39

FLASH POINT, CELSIUS: 73.00

SOLUBILITY, IN WATER: Insol 493 PPM

HEAT OF COMBUSTION, KCAL/MOLE: 886.40

COMBUSTION RANKING: 36

TOXICITY DATA: Cancer suspect agent; corrosive

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

SOLUTIONS:

RECORD NUMBER:

27

DATE OF LATEST ENTRY:

03/27/91

COMPOUND: Beryllium and compounds, N.O.S.
Beryllium

CAS REGISTRY NO: 7440-41-7

FORMULA: Be

MOLECULAR WEIGHT: 9.01

COMPOUND CLASS: Metal

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 2970

MELTING POINT, CELSIUS: 1287

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE: 140.2

COMBUSTION RANKING:

TOXICITY DATA: Highly toxic; cancer suspect agent

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train) EPA 103,

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic spectroscopy)

VALIDATION STATUS:

For method evaluation, see Steinsburger, S.L. et al "Measurement Methodology for Toxic Metals from Municipal Waste Combustors". Paper 5C-1, Conference on Municipal Waste Combustors, Hollywood, FL April, 1989.

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER:

28

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Biphenyl
Diphenyl

CAS REGISTRY NO: 92-52-4

FORMULA: C6-H5-C6-H5

MOLECULAR WEIGHT: 154.21

COMPOUND CLASS: Aromatic hydrocarbon

APPENDIX 8? N

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 255

MELTING POINT, CELSIUS: 70.5

FLASH POINT, CELSIUS: 113

SOLUBILITY, IN WATER: 7.5 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Causes convulsions and paralysis.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 105 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: Bis(2-chloroethyl) ether
Dichloroethyl ether
Ethane, 1,1-oxybis(2-chloro)-

CAS REGISTRY NO: 111-44-4

FORMULA: C4-H8-(Cl)2-O

MOLECULAR WEIGHT: 143.02

COMPOUND CLASS: Chlorinated ether

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 183

BOILING POINT, CELSIUS: 178

MELTING POINT, CELSIUS: -24.5

FLASH POINT, CELSIUS: 63.00

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE: 597.8

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent; lachrymator

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous
Sampling

SPECIFIC PROBLEM TYPE(S): Toxic
Reactive

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER: 29 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Bis(chloromethyl) ether
Methane, oxybis(chloro)-

CAS REGISTRY NO: 542-88-1

FORMULA: C2-H4-(Cl)2-O

MOLECULAR WEIGHT: 114.96

COMPOUND CLASS: Chlorinated ether

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 222

BOILING POINT, CELSIUS: 104 (at 760 mm)

MELTING POINT, CELSIUS: -41.5

FLASH POINT, CELSIUS: <19

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Decomposes in water, and is unlikely to survive the stack gas atmosphere.

SOLUTIONS:

Avoid as POHC if possible. Compound recovery must be demonstrated.

RECORD NUMBER:

30

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Bis(2-ethylhexyl) phthalate
1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
DEPH

CAS REGISTRY NO: 117-81-7

FORMULA: C24-H38-O4

MOLECULAR WEIGHT: 390.62

COMPOUND CLASS: Aromatic ester

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 6

UDRI THERMAL STABILITY RANKING: 269

BOILING POINT, CELSIUS: 384

MELTING POINT, CELSIUS: -50

FLASH POINT, CELSIUS: 215

SOLUBILITY, IN WATER: VERY SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE: 3290.00

COMBUSTION RANKING: 1

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

FOR HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 2 (EPA-600/8-87-037c).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 31

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Bromoform
Tribromomethane

CAS REGISTRY NO: 75-25-2

FORMULA: C-H-Br₃

MOLECULAR WEIGHT: 252.75

COMPOUND CLASS: Halogenated hydrocarbon

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 203

BOILING POINT, CELSIUS: 149.5

MELTING POINT, CELSIUS: 8.3

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 800 ppm

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: May cause death or serious injury. Narcotic. Causes liver damage

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

Unknown

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 32

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Bromomethane
METHYL BROMIDE

CAS REGISTRY NO: 74-83-9

FORMULA: C-H3-Br

MOLECULAR WEIGHT: 94.94

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 31

BOILING POINT, CELSIUS: 3.56

MELTING POINT, CELSIUS: -93.6

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly sol 17,5g/L

HEAT OF COMBUSTION, KCAL/MOLE: 328.40

COMBUSTION RANKING: 91

TOXICITY DATA: Highly Toxic

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Breakthrough

DESCRIPTION OF PROBLEMS:

Boiling point is below limit of 30 C for optimum VOST performance. Thus, breakthrough is possible if care is not taken.

SOLUTIONS:

Samples need to be analyzed as soon after sampling as possible to prevent losses. Laboratory validation should be done before field application.

RECORD NUMBER: 33

DATE OF LATEST ENTRY: 12/13/90

COMPOUND: 1,3-Butadiene
Vinylethylene

CAS REGISTRY NO: 106-99-0

FORMULA: C₄H₆

MOLECULAR WEIGHT: 54.09

COMPOUND CLASS: Hydrocarbon

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -4.5

MELTING POINT, CELSIUS: -109

FLASH POINT, CELSIUS: -76

SOLUBILITY, IN WATER: 735 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Irritant. Can cause burns or frostbite.

SAMPLING METHOD: Tedlar bag

ANALYSIS METHOD:

GC/FID or GC/MS

VALIDATION STATUS:

The use of bags has been validated.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 127 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: 1,3-Butadiene, 2-chloro-
Chloroprene
2-Chloro-1,3-butadiene

CAS REGISTRY NO: 126-99-8

FORMULA: (C1)-C4-H5

MOLECULAR WEIGHT: 88.54

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 69

BOILING POINT, CELSIUS: 59

MELTING POINT, CELSIUS: -130

FLASH POINT, CELSIUS: 21.00

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/Purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 34 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Cadmium and compounds, N.O.S.
Cadmium

CAS REGISTRY NO: 7440-43-9

FORMULA: Cd

MOLECULAR WEIGHT: 112.40

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 765

MELTING POINT, CELSIUS: 320.9

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic Spectroscopy)

VALIDATION STATUS:

For evaluation of this method, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors" Paper 5C-1 presented at "International Conference on Municipal Waste Combustors", Hollywood, FL, April, 1989.

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER:

35

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Calcium cyanamide
Calcium carbimide
Nitroline

CAS REGISTRY NO: 156-62-7

FORMULA: C-Ca-N2-H2

MOLECULAR WEIGHT: 80.11

COMPOUND CLASS: Salt

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 1340

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Sol.

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity via oral and inhalation routes.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

36

DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Caprolactam
Cyclohexanoneisooxime

CAS REGISTRY NO: 105-60-2

FORMULA: C6-H11-N-O

MOLECULAR WEIGHT: 113.16

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 137

MELTING POINT, CELSIUS: 71

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Lung irritant. Can cause death if inhaled.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 37 DATE OF LATEST ENTRY: 03/27/91

COMPOUND: Carbamic acid, methyl-, 1-naphthyl ester
Carbaryl
Savin

CAS REGISTRY NO: 63-25-2

FORMULA: C12-H11-N-O2

MOLECULAR WEIGHT: 201.24

COMPOUND CLASS: Carbamate

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: DECOMP

MELTING POINT, CELSIUS: 145

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 40 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8318 (HPLC)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 38

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Carbon disulfide
Carbon bisulfide

CAS REGISTRY NO: 75-15-0

FORMULA: C-S2

MOLECULAR WEIGHT: 76.14

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 46.3

MELTING POINT, CELSIUS: -110.8

FLASH POINT, CELSIUS: -30.00

SOLUBILITY, IN WATER: SOL2,200 PPM

HEAT OF COMBUSTION, KCAL/MOLE: 403.00

COMBUSTION RANKING: 82

TOXICITY DATA: Toxic; flammable liquid.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

No validated sampling and analysis method identified.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Decomposes on standing for a long time. Acute fire and explosion hazard, can be ignited by hot steam pipes.

SOLUTIONS:

Do not let stand for any length of time.

Avoid hot steam pipes.

RECORD NUMBER: 39

DATE OF LATEST ENTRY: 12/13/90

COMPOUND: Carbonyl sulfide
Carbon oxysulfide

CAS REGISTRY NO: 463-58-1

FORMULA: C-O-S

MOLECULAR WEIGHT: 60.07

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -50

MELTING POINT, CELSIUS: -138

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 1000 mL/L

HEAT OF COMBUSTION, KCAL/MOLE: 130.5

COMBUSTION RANKING:.

TOXICITY DATA: High toxicity via inhalation. Narcotic. Can cause death.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

40

DATE OF LATEST ENTRY: 12/17/90

COMPOUND: Catechol
1,2-dihydroxybenzene

CAS REGISTRY NO: 120-80-9

FORMULA: C6-H6-O2

MOLECULAR WEIGHT: 110.11

COMPOUND CLASS: Phenol

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 245

MELTING POINT, CELSIUS: 105

FLASH POINT, CELSIUS: 137

SOLUBILITY, IN WATER: 451 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity via oral and dermal exposure.

SAMPLING METHOD: SW-846, Method 0010 (MM5)

ANALYSIS METHOD:

SW-846, Method 8270 (extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water soluble

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

Careful control of pH during extraction of condensate is essential for complete recovery. Backup extraction with tert-butyl methyl ether may be needed.

RECORD NUMBER:

41

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chloramben
3-Amino-2,5-dichlorobenzoic acid
Amiben

CAS REGISTRY NO: 133-90-4

FORMULA: C7-H5-(Cl)2-N-O2

MOLECULAR WEIGHT: 206.00

COMPOUND CLASS: Herbicide

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 200.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 700 mg/kg at 25

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate irritant via oral route. Decomposition --> Toxic fumes.

SAMPLING METHOD: SW-846, No. 0010 (MM5)

ANALYSIS METHOD:

HPLC

VALIDATION STATUS:

Sampling method is not validated for this compound.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Stability

DESCRIPTION OF PROBLEMS:

Stability during sampling, shipping and recovery from components is a potential problem which needs to be checked.

SOLUTIONS:

RECORD NUMBER:

42

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chlordane (alpha and gamma isomers)
Chlordane

CAS REGISTRY NO: 57-74-9

FORMULA: C₁₀H₆(Cl)₈

MOLECULAR WEIGHT: 409.80

COMPOUND CLASS: Organochlorine pesticide

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 221

BOILING POINT, CELSIUS: 175

MELTING POINT, CELSIUS: 105

FLASH POINT, CELSIUS: 56

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE: 901.6

COMBUSTION RANKING:

TOXICITY DATA: Moderately irritating to skin.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Loses its chlorine in presence of alkaline reagents.

SOLUTIONS:

Should not be formulated with any solvent, carrier, diluent or emulsifier, having alkaline reagents.

RECORD NUMBER: 43

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chlorine

CAS REGISTRY NO: 7782-50-5

FORMULA: (Cl)₂

MOLECULAR WEIGHT: 70.91

COMPOUND CLASS: Halogen

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -34

MELTING POINT, CELSIUS: -101

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 14.6g/L @ 0

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 Draft Method No. 0050 or 0051 (NaOH Impinger)

ANALYSIS METHOD:

SW-846 Draft Method No. 9057 (Ion Chromatography)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 44

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chloroacetic acid

CAS REGISTRY NO: 79-11-8

FORMULA: C2-H3-O2-(Cl)

MOLECULAR WEIGHT: 94.50

COMPOUND CLASS: Acid

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 189

MELTING POINT, CELSIUS: 50 - 63

FLASH POINT, CELSIUS: 126.00

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Skin irritant.

SAMPLING METHOD: SW-846, No. 0010 (MM5)

ANALYSIS METHOD:

SW-846, No. 8270 after derivatization (Extraction HPLC/UV or GCMS)

VALIDATION STATUS:

Method 0010 has not been validated for this compound.

GENERAL PROBLEM TYPE(S): Sampling
Analytical

SPECIFIC PROBLEM TYPE(S): Recovery

DESCRIPTION OF PROBLEMS:

Recovery may be a problem because of its highly polar nature.

SOLUTIONS:

RECORD NUMBER:

45

DATE OF LATEST ENTRY:

03/28/91

COMPOUND: 2-Chloroacetophenone
Phenacylchloride

CAS REGISTRY NO: 532-27-4

FORMULA: C8-H7-O-(Cl)

MOLECULAR WEIGHT: 154.6

COMPOUND CLASS: Chlorinated aromatic hydrocarbon

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 244

MELTING POINT, CELSIUS: 54-56

FLASH POINT, CELSIUS: 118

SOLUBILITY, IN WATER: Insoluble

HEAT OF COMBUSTION, KCAL/MOLE: 802.4

COMBUSTION RANKING:

TOXICITY DATA: Powerful irritant of skin.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 46 DATE OF LATEST ENTRY: 12/28/90

COMPOUND: Chlorobenzene
Benzene, chloro-

CAS REGISTRY NO: 108-90-7

FORMULA: C6-H5-(Cl)

MOLECULAR WEIGHT: 112.56

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 19

BOILING POINT, CELSIUS: 132

MELTING POINT, CELSIUS: -45.6

FLASH POINT, CELSIUS: 28.00

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE: 744.00

COMBUSTION RANKING: 50

TOXICITY DATA: Flammable liquid

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, SW-846 No. 8270

VALIDATION STATUS:

Recovery studies have shown that chlorobenzene can be recovered quantitatively from the VOST train. See "Development of the VOST for use in Determining Incinerator Efficiency", Hazardous and Industrial Waste: Fourth Symposium, ASTM STP 886, 335-343, 1986. Also see EPA-600/7-86-025. Chlorobenzene has also been validated with the MM5 method. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074 (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Recovery

DESCRIPTION OF PROBLEMS:

Boiling point is above limit of 100 C for optimum VOST performance. However, validation studies have demonstrated that recovery is good for this compound if the precautions listed below are followed. Compound may be lost during concentration of extract.

SOLUTIONS:

It is necessary to keep the front part of the VOST train above the boiling point of the compound during sample collection. The recommended temperature is 140 C. Also for 8270, the compound can be lost during the concentration step. If sample loss is encountered, concentration to not <5 mL (rather than 1 mL) may correct the problem. Labelled recovery spikes are important to evaluate loss.

RECORD NUMBER:

47

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chlorobenzilate
Benzeneacetic acid

CAS REGISTRY NO: 510-15-6

FORMULA: C16-H14-(Cl)2-O3

MOLECULAR WEIGHT: 325.20

COMPOUND CLASS: Aromatic ester

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 204

BOILING POINT, CELSIUS: 147

MELTING POINT, CELSIUS: 36-37.3

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly sol in water 10mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 48 DATE OF LATEST ENTRY: 03/28/91

COMPOUND: 1-Chloro-2,3-epoxypropane
Epichlorohydrin

CAS REGISTRY NO: 106-89-8

FORMULA: C3-H5-(Cl)-O

MOLECULAR WEIGHT: 92.53

COMPOUND CLASS: Epoxide

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 116.5

MELTING POINT, CELSIUS: -48

FLASH POINT, CELSIUS: 40.00

SOLUBILITY, IN WATER: 60 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 423.00

COMBUSTION RANKING: 77

TOXICITY DATA: Highly cancer suspect agent.

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, SW-846 No. 8270

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect

Compound may be reactive.

SOLUTIONS:

Compound recovery should be checked.

RECORD NUMBER: 49 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Chloroform
Trichloromethane

CAS REGISTRY NO: 67-66-3

FORMULA: C-H-(Cl)₃

MOLECULAR WEIGHT: 119.38

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 195

BOILING POINT, CELSIUS: 61.7

MELTING POINT, CELSIUS: -63.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 89.20

COMBUSTION RANKING: 121

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

The VOST method has been validated for this compound (see "Validation Studies of the Protocol for the VOST", JAPCA Vol. 37, No. 4, 388-394, 1987). (Also see "Recovery of POHCs and PICs from a VOST", EPA-600/7-86-025.)

GENERAL PROBLEM TYPE(S): Analysis
Hazardous

SPECIFIC PROBLEM TYPE(S): Interference
Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent.

Has been shown to have a 20% positive bias with VOST method.

Chloroform is a common PIC. Therefore, it would be difficult to achieve acceptable DRE in feed streams of low concentrations.

SOLUTIONS:

RECORD NUMBER: 50 DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chloromethane
Methyl chloride

CAS REGISTRY NO: 74-87-3
FORMULA: C-H3-(Cl)
MOLECULAR WEIGHT: 50.49
COMPOUND CLASS: Chlorinated hydrocarbon
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1
UDRI THERMAL STABILITY RANKING: 29

BOILING POINT, CELSIUS: -23.7
MELTING POINT, CELSIUS: -97.73
FLASH POINT, CELSIUS:
SOLUBILITY, IN WATER: 3030 mL/L

HEAT OF COMBUSTION, KCAL/MOLE: 148.4
COMBUSTION RANKING:

TOXICITY DATA: Flammable liquid

SAMPLING METHOD: Sampling bags or SW-846 No. 0030 (VOST)

ANALYSIS METHOD:
GC or SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Breakthrough

DESCRIPTION OF PROBLEMS:
Sensitive to moisture
Slightly soluble in water.
Boiling point is below limit of 30 C for optimum VOST performance. Thus, breakthrough is possible if care is not taken.

SOLUTIONS:
Best to use sampling bags for this compound, although dealing with a compound with a boiling point this low is difficult by any method. VOST might work with low sample volumes and great care. QC must be very thorough in either case. Samples should be analyzed with a minimum storage time, in no case longer than a week.

RECORD NUMBER: 51 DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Chloromethyl methyl ether
Methane, chloromethoxy-

CAS REGISTRY NO: 107-30-2

FORMULA: C2-H5-(Cl)-O

MOLECULAR WEIGHT: 80.52

COMPOUND CLASS: Chlorinated ether

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 218

BOILING POINT, CELSIUS: 59.15

MELTING POINT, CELSIUS: -103.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Carcinogen; flammable liquid.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous
Sampling

SPECIFIC PROBLEM TYPE(S): Toxic
Decomposition

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER:

52

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Chromium and compounds, N.O.S.
Chromium

CAS REGISTRY NO: 7440-47-3

FORMULA: Cr

MOLECULAR WEIGHT: 51.90

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 2642

MELTING POINT, CELSIUS: 1857

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic spectroscopy)

VALIDATION STATUS:

For method validation, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors" Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL 1989.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Draft Method 0012 yields total chromium values.

SOLUTIONS:

For hexavalent chromium, use SW-846 Draft Method No. 0013.

RECORD NUMBER: 53

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Cobalt

CAS REGISTRY NO: 7440-48-4

FORMULA: Co

MOLECULAR WEIGHT: 58.90

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 3100

MELTING POINT, CELSIUS: 1493

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent; irritant

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

SOLUTIONS:

RECORD NUMBER:

54

DATE OF LATEST ENTRY: 09/27/90

COMPOUND: Coke Oven Emissions

CAS REGISTRY NO:

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 55

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: m-Cresol
3-methyl phenol

CAS REGISTRY NO: 108-39-4

FORMULA: C-H3-C6-H4-O-H

MOLECULAR WEIGHT: 108.14

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 103

BOILING POINT, CELSIUS: 202

MELTING POINT, CELSIUS: 11.5

FLASH POINT, CELSIUS: 86.00

SOLUBILITY, IN WATER: Soluble in 40 parts water, in solns of alkali hydroxides

HEAT OF COMBUSTION, KCAL/MOLE: 880.50

COMBUSTION RANKING: 39

TOXICITY DATA: Highly toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Hazardous
Hazardous

SPECIFIC PROBLEM TYPE(S): Incompatibility
Toxic

DESCRIPTION OF PROBLEMS:

Incompatible with strong oxidizing agents; it can react exothermically with strong bases, with fuming sulfuric acid (oleum), nitric acid, and chlorosulfonic acid. Thermal oxidative degradations produce toxic vapors.

SOLUTIONS:

Store in a cool place away from oxidizing agents and sources of ignition. Avoid contact with aluminum, copper, and brass alloys.

RECORD NUMBER:

56

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: o-Cresol
2-Methyl phenol

CAS REGISTRY NO: 95-48-7

FORMULA: C-H3-C6-H4-O-H

MOLECULAR WEIGHT: 108.14

COMPOUND CLASS: Phenol

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 104

BOILING POINT, CELSIUS: 191.5

MELTING POINT, CELSIUS: 30

FLASH POINT, CELSIUS: 82.00

SOLUBILITY, IN WATER: Soluble in 40 parts water; solns fixed alkali hydroxides

HEAT OF COMBUSTION, KCAL/MOLE: 882.60

COMBUSTION RANKING: 38

TOXICITY DATA: Highly toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600-8-87-037b).

GENERAL PROBLEM TYPE(S): Hazardous
Hazardous

SPECIFIC PROBLEM TYPE(S): Incompatibility
Toxic

DESCRIPTION OF PROBLEMS:

Incompatible with strong oxidizing agents; it can react exothermally with strong bases, with fuming sulfuric acid (oleum), nitric acid, and chlorosulfonic acid. Thermal oxidative degradations produce toxic vapors.

SOLUTIONS:

Store in a cool place away from oxidizing agents and sources of ignition. Avoid contact with aluminum, copper, and brass alloys.

RECORD NUMBER: 57

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: p-Cresol
4-Methyl phenol

CAS REGISTRY NO: 106-44-5

FORMULA: C-H3-C6-H4-O-H

MOLECULAR WEIGHT: 108.14

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 104

BOILING POINT, CELSIUS: 202

MELTING POINT, CELSIUS: 33

FLASH POINT, CELSIUS: 86.00

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 883.99

COMBUSTION RANKING: 37

TOXICITY DATA: Highly toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Hazardous
Hazardous

SPECIFIC PROBLEM TYPE(S): Incompatibility
Toxic

DESCRIPTION OF PROBLEMS:

Incompatible with strong oxidizing agents; it can react exothermically with strong bases, with fuming sulfuric acid (oleum), nitric acid, and chlorosulfonic acid. Thermal oxidative degradations produce toxic vapors.

SOLUTIONS:

Store in a cool place away from oxidizing agents and sources of ignition. Avoid contact with aluminum, copper, and brass alloys.

RECORD NUMBER: 58

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Cresols/ Cresylic acid
See O,M or P Cresol

CAS REGISTRY NO: 131-97-73

FORMULA: C7-H8-O

MOLECULAR WEIGHT: 108.1

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 191

MELTING POINT, CELSIUS: 10.9-35.5

FLASH POINT, CELSIUS: 81.00

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE: 880

COMBUSTION RANKING:

TOXICITY DATA: Skin, eye irritant. Moderate toxicity. Can cause severe burns.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

GC/MS or HPLC

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

This is a mixture of isomers.

SOLUTIONS:

RECORD NUMBER: 59

DATE OF LATEST ENTRY: 03/28/91

COMPOUND: Cumene
Isopropyl benzene

CAS REGISTRY NO: 98-82-8

FORMULA: C9-H12

MOLECULAR WEIGHT: 120.20

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 153

MELTING POINT, CELSIUS: -96

FLASH POINT, CELSIUS: 46.0

SOLUBILITY, IN WATER: 50 mg/L

HEAT OF COMBUSTION, KCAL/MOLE: 1247

COMBUSTION RANKING:

TOXICITY DATA: Potent narcotic. CNS depressant. Moderate Toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 60 DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Cyanides (soluble salts and complexes), N.O.S.
Cyanides

CAS REGISTRY NO: 57-12-5

FORMULA: CN

MOLECULAR WEIGHT: 26.02

COMPOUND CLASS: Inorganic salt

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: Collection with filter and impinger

ANALYSIS METHOD:

Extraction with 0.1N NaOH, ion specific electrode

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis
Hazard

SPECIFIC PROBLEM TYPE(S): Interference
Toxic

DESCRIPTION OF PROBLEMS:

Sulfide ion irreversibly poisons the cyanide ion specific electrode.

SOLUTIONS:

Sulfide is removed by the addition of a small amount of powdered cadmium carbonate to the pH 11-13 range.

RECORD NUMBER: 61 DATE OF LATEST ENTRY: 03/28/91
COMPOUND: 4-Cyclohexene-1,2-dicarboximide, N-(trichloromethyl)thio-
Captan

CAS REGISTRY NO: 133-06-2
FORMULA: C9-H8-(Cl)3-N-O2-S
MOLECULAR WEIGHT: 300.59
COMPOUND CLASS: Halogenated Hydrocarbon
APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:
UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 172.5
MELTING POINT, CELSIUS:
FLASH POINT, CELSIUS:
SOLUBILITY, IN WATER: Insol. 3.3 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:
COMBUSTION RANKING:

TOXICITY DATA: Low oral toxicity.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

62

DATE OF LATEST ENTRY:

03/28/91

COMPOUND:

DDE

Benzene, 1,1'-(dichloroethenylidene)bis-4-chloro-

CAS REGISTRY NO: 72-55-9

FORMULA: C14-H8-(Cl)4

MOLECULAR WEIGHT: 318.03

COMPOUND CLASS: Organochlorine pesticide

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 38

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 89

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.010 PPM

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 220 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: 2,4-Diaminotoluene
2,4- Toluene diamine

CAS REGISTRY NO: 95-80-7

FORMULA: C7-H10-N2

MOLECULAR WEIGHT: 122.17

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 69

BOILING POINT, CELSIUS: 283

MELTING POINT, CELSIUS: 97

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent; toxic

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

SOLUTIONS:

RECORD NUMBER: 63

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Diazomethane

CAS REGISTRY NO: 334-88-3

FORMULA: C-H2-N2

MOLECULAR WEIGHT: 42.04

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -23

MELTING POINT, CELSIUS: -145.

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Powerful allergen. Highly toxic.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Explosive

DESCRIPTION OF PROBLEMS:

Explosion hazard by heat or shock. Highly reactive material.

SOLUTIONS:

RECORD NUMBER: 64

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: Dibenzofuran

CAS REGISTRY NO: 132-64-9

FORMULA: C12-H8-O

MOLECULAR WEIGHT: 168.20

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 154

MELTING POINT, CELSIUS: 84

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 10 PPM

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

64-a

RECORD NUMBER: 235 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: 1,2-Dibromoethane
Ethylene dibromide
EDB

CAS REGISTRY NO: 106-93-4

FORMULA: C2-H4-Br2

MOLECULAR WEIGHT: 187.87

COMPOUND CLASS: Brominated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 199

BOILING POINT, CELSIUS: 131

MELTING POINT, CELSIUS: 9.79

FLASH POINT, CELSIUS: 10

SOLUBILITY, IN WATER: Sol in about 250 parts of water.

HEAT OF COMBUSTION, KCAL/MOLE: 242.2

COMBUSTION RANKING:

TOXICITY DATA: Carcinogen

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, SW-846 No. 8270

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Recovery

DESCRIPTION OF PROBLEMS:

Cancer suspect agent

Boiling point is above limit of 100 C for optimum VOST performance.

SOLUTIONS:

The compound recovery should be checked. If Method 0030 is used, the front end of the train must be maintained at a temperature of 138 C or above.

RECORD NUMBER: 65 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,2-Dibromo-3-chloropropane
Propane, 1,2-dibromo-3-chloro
Nemagon

CAS REGISTRY NO: 96-12-8

FORMULA: C3-H5-Br2-(Cl)

MOLECULAR WEIGHT: 236.35

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 214

BOILING POINT, CELSIUS: 196

MELTING POINT, CELSIUS: 5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Carcinogen

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 66 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: Di-n-butyl phthalate
Dibutyl phthalate

CAS REGISTRY NO: 84-74-2

FORMULA: C16-H22-O4

MOLECULAR WEIGHT: 278.38

COMPOUND CLASS: Aliphatic ester

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 6

UDRI THERMAL STABILITY RANKING: 261

BOILING POINT, CELSIUS: 340

MELTING POINT, CELSIUS: -35

FLASH POINT, CELSIUS: 157

SOLUBILITY, IN WATER: 11 MG/L

HEAT OF COMBUSTION, KCAL/MOLE: 2055.00

COMBUSTION RANKING: 9

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID, GC/MS, and HPLC/UV analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b) and Vol 2 (EPA-600/8-87-037c).

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Blank
Interference

DESCRIPTION OF PROBLEMS:

Phthalates are often used as plasticizers and are common lab contaminants. If very low levels are needed to achieve DRE, it may be necessary to choose an alternate POHC.

SOLUTIONS:

Determine normal lab blanks well in advance of testing. Compare level of blanks with levels of concern for samples. It may be necessary to seek a laboratory with lower blank levels or to select a different POHC.

RECORD NUMBER:

67

DATE OF LATEST ENTRY:

09/25/90

COMPOUND: p-Dichlorobenzene
Benzene, 1,4-dichloro-

CAS REGISTRY NO: 106-46-7

FORMULA: C6-H4-(Cl)2

MOLECULAR WEIGHT: 147.00

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 21

BOILING POINT, CELSIUS: 174

MELTING POINT, CELSIUS: 53.5

FLASH POINT, CELSIUS: 78.00

SOLUBILITY, IN WATER: Practically insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Toxic; irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

May be lost in sample concentration step.

Sublimes at ordinary temperatures.

SOLUTIONS:

Labelled recovery spikes are important. Do not allow to go dryness.

RECORD NUMBER:

68

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 3,3'-Dichlorobenzidine
[1,1'-Biphenyl-4,4'-diamine, 3,3'-dichloro-

CAS REGISTRY NO: 91-94-1

FORMULA: C12-H10-(Cl)2-N2

MOLECULAR WEIGHT: 253.14

COMPOUND CLASS: Aromatic amine

APPENDIX 8? 1

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 67

BOILING POINT, CELSIUS: 402

MELTING POINT, CELSIUS: 132

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Almost insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Carcinogen

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS) or HPLC/UV.

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 251 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: 1,2-Dichloroethane
Ethylene dichloride

CAS REGISTRY NO: 107-06-2
FORMULA: C2-H4-(Cl)2
MOLECULAR WEIGHT: 98.96
COMPOUND CLASS: Chlorinated hydrocarbon
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4
UDRI THERMAL STABILITY RANKING: 131

BOILING POINT, CELSIUS: 83
MELTING POINT, CELSIUS: -35.36
FLASH POINT, CELSIUS: 13.00
SOLUBILITY, IN WATER: 8.7 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 297.00
COMBUSTION RANKING: 96

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:
SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:
Recoveries from the VOST have been validated. See "Development of the VOST for use in Determining Incinerator Efficiency", Hazardous and Industrial Solid Waste Testing: Fourth Symposium, ASTM STP 886, pp. 335-343, (1986).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

69

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,1-Dichloroethylene
Ethene, 1,1-dichloro-
Vinylidene chloride

CAS REGISTRY NO: 75-35-4

FORMULA: C2-H2-(Cl)2

MOLECULAR WEIGHT: 96.94

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 31.7 (at 760 mm)

MELTING POINT, CELSIUS: -122.1

FLASH POINT, CELSIUS: -16

SOLUBILITY, IN WATER: INSOL 2.5 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 262.00

COMBUSTION RANKING: 102

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 70 DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Dichloromethane
Methylene chloride

CAS REGISTRY NO: 75-09-2
FORMULA: CH₂-(Cl)₂
MOLECULAR WEIGHT: 84.93
COMPOUND CLASS: Chlorinated hydrocarbon
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2
UDRI THERMAL STABILITY RANKING: 65

BOILING POINT, CELSIUS: 40
MELTING POINT, CELSIUS: -95.1
FLASH POINT, CELSIUS:
SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 145.00
COMBUSTION RANKING: 114

TOXICITY DATA: Narcotic in high concentration

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:
SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous
Analysis

SPECIFIC PROBLEM TYPE(S): Toxic
Interference

DESCRIPTION OF PROBLEMS:

Toxic hazards are increased by the presence of alcohol and/or carbon monoxide and by heavy labor and smoking.
Dichloromethane is a common laboratory air contaminant.

SOLUTIONS:

Normal blank levels need to be ascertained well before testing. If blank levels are high enough to cause serious interference in analysis and unacceptable increases in quantitation limits, it may be necessary to carry out analysis in a special organic-free laboratory. This problem is most serious when waste feed concentration of dichloromethane are low.

70.0
RECORD NUMBER: 259 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: 2,4-Dichlorophenoxyacetic acid
2,4-D

CAS REGISTRY NO: 94-75-7
FORMULA: C8-H6-(CL)2-O3
MOLECULAR WEIGHT: 221.04
COMPOUND CLASS: Chlorphenoxy herbicide
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5
UDRI THERMAL STABILITY RANKING: 211

BOILING POINT, CELSIUS: 160
MELTING POINT, CELSIUS: 140
FLASH POINT, CELSIUS: 88
SOLUBILITY, IN WATER: 540 PPM

HEAT OF COMBUSTION, KCAL/MOLE: 95.1
COMBUSTION RANKING:

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
SW-846 No. 8270 (Extraction, GC/MS) or Extraction, HPLC/UV

VALIDATION STATUS:
For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 71 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,2-Dichloropropane
Propylene Dichloride

CAS REGISTRY NO: 78-87-5
FORMULA: C3-H6-(Cl)2
MOLECULAR WEIGHT: 112.99
COMPOUND CLASS: Chlorinated hydrocarbon
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4
UDRI THERMAL STABILITY RANKING: 179

BOILING POINT, CELSIUS: 95
MELTING POINT, CELSIUS: -100
FLASH POINT, CELSIUS: 21.00
SOLUBILITY, IN WATER: Slightly soluble

HEAT OF COMBUSTION, KCAL/MOLE: 450.10
COMBUSTION RANKING: 74

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:
SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 72 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,3-Dichloropropene
1-Propene, 1,3-dichloro-

CAS REGISTRY NO: 542-75-6

FORMULA: C3-H4-(Cl)2

MOLECULAR WEIGHT: 110.97

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 108

MELTING POINT, CELSIUS: < -50

FLASH POINT, CELSIUS: 25

SOLUBILITY, IN WATER: 0.15%

HEAT OF COMBUSTION, KCAL/MOLE: 432.8

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, SW-846 No. 8270

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

If Method 0030 is used, the compound recovery should be checked.

RECORD NUMBER:

73

DATE OF LATEST ENTRY:

04/09/91

COMPOUND: Dichlorvos
Dichlorovinyl dimethylphosphate
DDVP

CAS REGISTRY NO: 62-73-7

FORMULA: C4-H7-O4-(Cl)2-P

MOLECULAR WEIGHT: 221.00

COMPOUND CLASS: Organophosphate pesticide

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 120 at 14 mm

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: >79

SOLUBILITY, IN WATER: 1%

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Can be absorbed through skin. Can cause death if taken orally.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8141

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Breakthrough

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

Wear gloves and respirator.

RECORD NUMBER: 74

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: edithanolamine
edit-hydroxyethyl)amine

CAS REGISTRY NO: 111-42-2

FORMULA: C4-H11-O2-N

MOLECULAR WEIGHT: 105.14

COMPOUND CLASS: Amine base

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 269

MELTING POINT, CELSIUS: 28.5

FLASH POINT, CELSIUS: 137

SOLUBILITY, IN WATER: 954 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity via oral route.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

75

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: ,N-Diethyl Aniline
N-phenyldiethylamine
Dimethyl Aniline

CAS REGISTRY NO: 91-66-7

FORMULA: C10-H15-N

MOLECULAR WEIGHT: 149.23

COMPOUND CLASS: Amine Base

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 216

MELTING POINT, CELSIUS: -38

FLASH POINT, CELSIUS: 85

SOLUBILITY, IN WATER: 14.4 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity by oral route.

SAMPLING METHOD:

ANALYSIS METHOD:

HPLC

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 76

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: Diethyl sulfate
Ethyl sulfate

CAS REGISTRY NO: 64-67-5

FORMULA: C4-H10-O4-S

MOLECULAR WEIGHT: 154.18

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 208

MELTING POINT, CELSIUS: -24

FLASH POINT, CELSIUS: 220

SOLUBILITY, IN WATER: 7 G/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen. Moderate to high toxicity.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

Uvalidated.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

This compound is very reactive with chloride bases.

SOLUTIONS:

RECORD NUMBER: 77 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 3,3'-Dimethoxybenzidine
[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-

CAS REGISTRY NO: 119-90-4

FORMULA: C14-H16-N2-O2

MOLECULAR WEIGHT: 244.32

COMPOUND CLASS: Amine

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 250

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 137

FLASH POINT, CELSIUS: 206

SOLUBILITY, IN WATER: Practically insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV).

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 78 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 3,3'-Dimethylbenzidine
1,1'-Biphenyl-4,4'-diamine, 3,3'-dimethyl-

CAS REGISTRY NO: 119-93-7

FORMULA: C14-H16-N2

MOLECULAR WEIGHT: 212.32

COMPOUND CLASS: Amine

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 78

BOILING POINT, CELSIUS: 300

MELTING POINT, CELSIUS: 131

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE: 964.3

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV),

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 79 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Dimethylcarbamoyl chloride
Carbamic chloride, dimethyl-

CAS REGISTRY NO: 79-44-7
FORMULA: C3-H6-(Cl)-N-O
MOLECULAR WEIGHT: 107.55
COMPOUND CLASS: Carbamate
APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4
UDRI THERMAL STABILITY RANKING: 175

BOILING POINT, CELSIUS: 167 (at 775 mm)
MELTING POINT, CELSIUS: -33
FLASH POINT, CELSIUS:
SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:
COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Decomposition
Recovery

DESCRIPTION OF PROBLEMS:
Decomposes in water, and unlikely to survive the stack gas atmosphere.

SOLUTIONS:

RECORD NUMBER: 80

DATE OF LATEST ENTRY: 12/27/90

COMPOUND: Dimethyl formamide

CAS REGISTRY NO: 68-12-2

FORMULA: C3-H7-O-N

MOLECULAR WEIGHT: 73.10

COMPOUND CLASS: Amide

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 153

MELTING POINT, CELSIUS: -61

FLASH POINT, CELSIUS: 57.00

SOLUBILITY, IN WATER: Soluble

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High inhalation hazard. An experimental mutagen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

Method 0010 is not validated for this compound.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Water solubility may be a problem.

SOLUTIONS:

RECORD NUMBER: 81 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,1-Dimethylhydrazine
Hydrazine, 1,1-dimethyl-

CAS REGISTRY NO: 57-14-7

FORMULA: C2-H8-N2

MOLECULAR WEIGHT: 60.12

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 216

BOILING POINT, CELSIUS: 63 (at 752 mm)

MELTING POINT, CELSIUS: -55

FLASH POINT, CELSIUS: -15

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE: 473.00

COMBUSTION RANKING: 72

TOXICITY DATA: Corrosive to skin

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water soluble

DESCRIPTION OF PROBLEMS:

Very soluble in water, and therefore is likely to be present in the condensate trap of the samplingtrain. This compound is also unstable.

SOLUTIONS:

The extract from the condensate liquid should be analyzed by GC/MS. The analysis should be validated.

RECORD NUMBER: 82 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: Dimethyl phthalate
1,2-Benzenedicarboxylic acid, dimethyl ester

CAS REGISTRY NO: 131-11-33

FORMULA: C10-H10-O4

MOLECULAR WEIGHT: 194.19

COMPOUND CLASS: Aliphatic ester

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 92

BOILING POINT, CELSIUS: 283.8

MELTING POINT, CELSIUS: 1

FLASH POINT, CELSIUS: 146

SOLUBILITY, IN WATER: Practically insol 4.3 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 119.70

COMBUSTION RANKING: 27

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Blank

DESCRIPTION OF PROBLEMS:

Phthalates are common laboratory contaminants. If low levels are needed to achieve the desired DRE, it may be necessary to choose an alternate POHC.

SOLUTIONS:

RECORD NUMBER: 83

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: Dimethyl sulfate
Sulfuric acid, dimethyl ester

CAS REGISTRY NO: 77-78-1

FORMULA: C2-H6-O4-S

MOLECULAR WEIGHT: 126.13

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 188 DECOMP

MELTING POINT, CELSIUS: -27

FLASH POINT, CELSIUS: 83

SOLUBILITY, IN WATER: 2.8 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 667.38

COMBUSTION RANKING: 59

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Decomposes at 188 degrees centigrade.

Solidifies at -27 degrees centigrade.

SOLUTIONS:

Do not heat above 187 degrees centigrade.

Do not melt.

RECORD NUMBER: 84 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 4,6-Dinitro-o-cresol (and salts)
4,6-Dinitro-o-cresol

CAS REGISTRY NO: 2312-76-7

FORMULA: C7-H6-N2-O5

MOLECULAR WEIGHT: 220.13

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 312

MELTING POINT, CELSIUS: 87.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.013% (AS SALTS-SOL)

HEAT OF COMBUSTION, KCAL/MOLE: 862.9

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 85 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 2,4-Dinitrophenol
Phenol, 2,4-dinitro-

CAS REGISTRY NO: 51-28-5

FORMULA: C6-H4-N2-O5

MOLECULAR WEIGHT: 184.11

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 183

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 107

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Very sparingly soluble in cold water 5.6 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 645.00

COMBUSTION RANKING: 62

TOXICITY DATA: Highly toxic; flammable solid

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV).

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

86

DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 2,4-Dinitrotoluene
Benzene, 1-methyl-2,4-dinitro-

CAS REGISTRY NO: 121-14-2

FORMULA: C7-H6-N2-O4

MOLECULAR WEIGHT: 182.14

COMPOUND CLASS:

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 168

BOILING POINT, CELSIUS: 300

MELTING POINT, CELSIUS: 69

FLASH POINT, CELSIUS: 207

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE: 846.00

COMBUSTION RANKING: 42

TOXICITY DATA: Cancer suspect agent; toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER:

87

DATE OF LATEST ENTRY:

04/09/91

COMPOUND: 1,4-Dioxane
1,4-Diethyleneoxide

CAS REGISTRY NO: 123-91-1

FORMULA: C4-H8-O2

MOLECULAR WEIGHT: 88.10

COMPOUND CLASS: Water-Soluble POHCs

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 141

BOILING POINT, CELSIUS: 101

MELTING POINT, CELSIUS: 11.8

FLASH POINT, CELSIUS: 5.00

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 581

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent; flammable liquid

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

The MM5 method has been validated. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074, (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method". EPA-600/4-85-075a, November 1985.

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water soluble

DESCRIPTION OF PROBLEMS:

Forms explosive peroxides when hydrolyzed. Soluble in water, and therefore is likely to be present in the condensate trap of the sampling train.

Validation studies have shown that recovery from the VOST train is poor because of the water solubility. See "Development of VOST Sample Analysis Protocol for Water-Soluble Volatile POHCs and PICs" (EPA-600/8-87-008 February 1987).

SOLUTIONS:

The extract from the condensate liquid should be analyzed by GC/MS. Labelled recovery spikes are required to demonstrate recoveries. Care must be taken during sample concentration to prevent loss.

RECORD NUMBER: 88 DATE OF LATEST ENTRY: 04/09/91

COMPOUND: 1,2-Diphenylhydrazine

CAS REGISTRY NO: 122-66--7

FORMULA: C12-H12-N2

MOLECULAR WEIGHT: 184.24

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 251

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 123 DECOMP

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE: 1591.00

COMBUSTION RANKING: 11

TOXICITY DATA: Cancer suspect agent; toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Cancer suspect

SOLUTIONS:

RECORD NUMBER: 89

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: 1,2-Epoxybutane
1-Butene oxide

CAS REGISTRY NO: 106-88-7

FORMULA: C4-H8-O

MOLECULAR WEIGHT: 72.11

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 63

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: -12

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 610.8

COMBUSTION RANKING:

TOXICITY DATA: Moderate irritant, all routes.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Epoxides are reactive and may not remain intact during sampling.

SOLUTIONS:

A derivatization procedure may be useful. See "Reaction of Epoxides with 4-Nitrothiophenol. Its possible Application for Trapping and Characterization of Epoxides", Environ. Sci. Tech. 14, 1249-1253 (1980).

RECORD NUMBER: 90

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Ethyl acrylate
Ethyl propenoate

CAS REGISTRY NO: 140-88-5

FORMULA: C5-H8-O2

MOLECULAR WEIGHT: 100.12

COMPOUND CLASS: Ester

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 99

MELTING POINT, CELSIUS: -71.

FLASH POINT, CELSIUS: 15.0

SOLUBILITY, IN WATER: 20 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 690.8

COMBUSTION RANKING:

TOXICITY DATA: Skin irritant. Moderate toxicity. Affects heart, liver, & spleen

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 91

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Ethyl benzene

CAS REGISTRY NO: 100-41-4

FORMULA: C8-H10

MOLECULAR WEIGHT: 106.17

COMPOUND CLASS: Semivolatile hydrocarbon

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 136

MELTING POINT, CELSIUS: -95

FLASH POINT, CELSIUS: 22

SOLUBILITY, IN WATER: 140 mg/L

HEAT OF COMBUSTION, KCAL/MOLE: 1048.6

COMBUSTION RANKING:

TOXICITY DATA: Irritant to skin, eyes. Can cause death at high concentrations.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 92 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Ethyl carbamate
Urethane

CAS REGISTRY NO: 51-79-6
FORMULA: C3-H7-N-O2
MOLECULAR WEIGHT: 89.11
COMPOUND CLASS: Carbamate
APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5
UDRI THERMAL STABILITY RANKING: 204

BOILING POINT, CELSIUS: 182
MELTING POINT, CELSIUS: 48
FLASH POINT, CELSIUS:
SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 397.00
COMBUSTION RANKING: 83

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
SW-846 No. 8270 (Extraction, GC/MS) or Test Method 632

VALIDATION STATUS:
For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2" (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:
Incompatible with alkalies, acids, antipyrine, chloral hydrate, camphor, menthol, salol, or thymol.

SOLUTIONS:
Carbamate pesticides are normally analyzed by HPLC/UV.
Avoid contact with alkalies, acids, antipyrine, chloral hydrate, camphor, menthol, salol, or thymol.

RECORD NUMBER: 93

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Ethyl chloride
Chloroethane

CAS REGISTRY NO: 75-00-3

FORMULA: C2-H5-(Cl)

MOLECULAR WEIGHT: 64.52

COMPOUND CLASS: Chlorinated Hydrocarbon

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 12.3

MELTING POINT, CELSIUS: -139.

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 3.3 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 6311

COMBUSTION RANKING:

TOXICITY DATA: Skin and eye irritant. Moderate toxicity via oral & inhalation.

SAMPLING METHOD: Tedlar bag

ANALYSIS METHOD:

GC/MS

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 94

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Ethylene glycol
1,2-Ethanediol

CAS REGISTRY NO: 107-21-1

FORMULA: C2-H6-O2

MOLECULAR WEIGHT: 62.07

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 197

MELTING POINT, CELSIUS: -13

FLASH POINT, CELSIUS: 110.00

SOLUBILITY, IN WATER: Soluble

HEAT OF COMBUSTION, KCAL/MOLE: 281.9

COMBUSTION RANKING:

TOXICITY DATA: Skin and eye irritant.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 95

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Ethyleneimine
Aziridine

CAS REGISTRY NO: 151-56-4

FORMULA: C2-H5-N

MOLECULAR WEIGHT: 43.07

COMPOUND CLASS: Imine

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 235

BOILING POINT, CELSIUS: 56

MELTING POINT, CELSIUS: -78

FLASH POINT, CELSIUS: -24.00

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE: 381.00

COMBUSTION RANKING: 86

TOXICITY DATA: Poisonous! Handle in hood only!

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Therm Desorp/Purge and Trap-GC/MS), Draft 5041

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water Soluble

DESCRIPTION OF PROBLEMS:

Polymerizes easily.

Very soluble in water, and therefore is likely to be present in the condensate trap of the sampling train.

SOLUTIONS:

A longer purge time might be necessary for adequate recovery. It may also be necessary to heat and salt the purge water. Also, the extract from the condensate liquid should be analyzed by GC/MS.

RECORD NUMBER: 96

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Ethylene oxide

CAS REGISTRY NO: 75-21-8

FORMULA: C2-H4-O

MOLECULAR WEIGHT: 44.05

COMPOUND CLASS: Epoxide

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: A

UDRI THERMAL STABILITY RANKING: 174

BOILING POINT, CELSIUS: 10.7

MELTING POINT, CELSIUS: -111

FLASH POINT, CELSIUS: -18

SOLUBILITY, IN WATER: Sol

HEAT OF COMBUSTION, KCAL/MOLE: 302.00

COMBUSTION RANKING: 94

TOXICITY DATA: Explosive

SAMPLING METHOD: Gas sampling bag

ANALYSIS METHOD:

GC/FID

VALIDATION STATUS:

For method description, see "Chromatographic Methods for Analysis of Ethylene Oxide in Emissions from Stationary Sources", J. Chromatog. Sci 28, 204-209 (1990)

GENERAL PROBLEM TYPE(S): Hazardous
Analysis

SPECIFIC PROBLEM TYPE(S): Explosive
Water Soluble

DESCRIPTION OF PROBLEMS:

Will explode when mixed with alcohols or mercaptans. Reacts with HCl to form ethylene chlorohydrin which is very toxic.

SOLUTIONS:

RECORD NUMBER: 97

DATE OF LATEST ENTRY: 08/25/89

COMPOUND: Ethylenethiourea

CAS REGISTRY NO: 96-45-7

FORMULA: C3-H6-N2-S

MOLECULAR WEIGHT: 102.17

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 7

UDRI THERMAL STABILITY RANKING: 291

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 200

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect; teratogen

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

Extraction, HPLC/UV

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Parts 1 and 2 (EPA-600/8-87-037a and EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

98

DATE OF LATEST ENTRY:

04/10/91

COMPOUND: Ethylidene dichloride
1,1-Dichloroethene
Vinylidene chloride

CAS REGISTRY NO: 75-35-4

FORMULA: C₂H₂-(Cl)₂

MOLECULAR WEIGHT: 97.0

COMPOUND CLASS: Volatile

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: .

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 31.6

MELTING POINT, CELSIUS: -122.5

FLASH POINT, CELSIUS: -18

SOLUBILITY, IN WATER: Moderately Soluble 2.5 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 261.9

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen. Liver toxin. Can cause death. Skin Irr

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 99 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Formaldehyde

CAS REGISTRY NO: 50-00-0

FORMULA: C-H2-O

MOLECULAR WEIGHT: 30.00

COMPOUND CLASS: Aldehyde

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 46

BOILING POINT, CELSIUS: -21 (at 760 mm)

MELTING POINT, CELSIUS: -92

FLASH POINT, CELSIUS: 60.00

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 136.42

COMBUSTION RANKING: 115

TOXICITY DATA: Cancer suspect agent; toxic

SAMPLING METHOD: SW-846 Draft Method No. 0011 (DNPH Impinger)

ANALYSIS METHOD:

SW-846 Draft Method No. 8315 (Extraction-HPLC of DNPH derivative)

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling
Sampling

SPECIFIC PROBLEM TYPE(S): Water Soluble
Reactive

DESCRIPTION OF PROBLEMS:

Powerful reducing agent especially in presence of alkali. In air it is slowly oxidized to formic acid. Formaldehyde is water soluble. It is also a common PIC in combustion sources. Formaldehyde is analyzed by derivitization with DNPH and HPLC/UV.

SOLUTIONS:

Sample with aqueous acidic DPNH impinger to make a DNPH derivative. Do not select formaldehyde as POHC when waste feed concentration is very low.

RECORD NUMBER: 100

DATE OF LATEST ENTRY: 09/27/90

COMPOUND: Glycol Ethers

CAS REGISTRY NO:

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 101

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Heptachlor

CAS REGISTRY NO: 76-44-8

FORMULA: C₁₀H₅-(Cl)₇

MOLECULAR WEIGHT: 373.35

COMPOUND CLASS: Organochlorine pesticide

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 180

BOILING POINT, CELSIUS: 145 @ 1.5 mm

MELTING POINT, CELSIUS: 95

FLASH POINT, CELSIUS: NONFLAMM

SOLUBILITY, IN WATER: 0.03 PPM

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 102

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hexachlorobenzene

CAS REGISTRY NO: 118-74-1

FORMULA: C₆-(Cl)₆

MOLECULAR WEIGHT: 284.80

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 31

BOILING POINT, CELSIUS: 323

MELTING POINT, CELSIUS: 231

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Insol 0.035 ppm

HEAT OF COMBUSTION, KCAL/MOLE: 567.70

COMBUSTION RANKING: 65

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 103

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hexachlorobutadiene

CAS REGISTRY NO: 87-68-3

FORMULA: C4-(Cl)6

MOLECULAR WEIGHT: 260.76

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 92

BOILING POINT, CELSIUS: 215

MELTING POINT, CELSIUS: -21

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

104

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hexachlorocyclopentadiene

CAS REGISTRY NO: 77-47-4

FORMULA: C5-(Cl)6

MOLECULAR WEIGHT: 272.77

COMPOUND CLASS: Chlorinated aromatic

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 168

BOILING POINT, CELSIUS: 239 (at 753 mm)

MELTING POINT, CELSIUS: -9

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL 2 PPM

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Corrosive; toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 105

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hexachloroethane

CAS REGISTRY NO: 67-72-1

FORMULA: C₂-(Cl)₆

MOLECULAR WEIGHT: 236.74

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 202

BOILING POINT, CELSIUS: 187 (Sublimes)

MELTING POINT, CELSIUS: 187

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL 0.05 G/L

HEAT OF COMBUSTION, KCAL/MOLE: 110.00

COMBUSTION RANKING: 117

TOXICITY DATA: Cancer suspect agent; irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

The MM5 method was validated in the lab for this compound. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074, (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

106

DATE OF LATEST ENTRY:

04/10/91

COMPOUND: Hexamethylene-1,6-diisocyanate
1,6-Diisocyanatohexane
HDI

CAS REGISTRY NO: 822-06-0

FORMULA: C8-H12-O2-N2

MOLECULAR WEIGHT: 168.20

COMPOUND CLASS: Isocyanate

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 255

MELTING POINT, CELSIUS: 140

FLASH POINT, CELSIUS: 140

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Allergin. Moderate toxicity.

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

No validated stack sampling method.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Compound reacts with water during sampling. Violent reaction with alcohols.
When heated to decomposition, this compound emits toxic NOx fumes.

SOLUTIONS:

Compound must be derivatized during sampling. Method is under development.

RECORD NUMBER: 107

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Hexamethylphosphoramide
Hexamethylphosphoric acid triamide

CAS REGISTRY NO: 680-31-9

FORMULA: C6-H18-O-N3-P

MOLECULAR WEIGHT: 179.20

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 231

MELTING POINT, CELSIUS: 7

FLASH POINT, CELSIUS: 105.00

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Suspected human carcinogen. Moderate toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Chromatography

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 108

DATE OF LATEST ENTRY: 12/17/90

COMPOUND: Hexane

CAS REGISTRY NO: 110-54-3

FORMULA: C6-H14

MOLECULAR WEIGHT: 86.18

COMPOUND CLASS: Flammable Liquid

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 69

MELTING POINT, CELSIUS: -95

FLASH POINT, CELSIUS: -23.00

SOLUBILITY, IN WATER: 9.5 mg/L at 20 deg C

HEAT OF COMBUSTION, KCAL/MOLE: 995.01

COMBUSTION RANKING:

TOXICITY DATA: Low toxicity via oral route. Skin and eye irritant.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 109

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Hydrazine

CAS REGISTRY NO: 302-01-0

FORMULA: H4-N2

MOLECULAR WEIGHT: 32.00

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 127

BOILING POINT, CELSIUS: 113

MELTING POINT, CELSIUS: 2

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE: 7.21

COMBUSTION RANKING: 125

TOXICITY DATA: Cancer suspect agent; highly toxic

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, Draft Method No. 5041 or SW-846 No. 8270

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water soluble

DESCRIPTION OF PROBLEMS:

May not elute from GC column. Very soluble in water, and therefore is likely to be present in condensate trap of the sampling train or the purge chamber of Method 5040. This compound is unstable. Another problem is the MW of 32 which will be difficult to see above the MS oxygen background.

SOLUTIONS:

A longer purge time might give better recoveries. Also, the extract from the condensate liquid should be analyzed. Adequate recoveries must be demonstrated. May require a special sampling and analysis method. NIOSH uses impinger collection, derivatization and UV determination.

RECORD NUMBER: 110

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hydrochloric acid
Hydrogen chloride

CAS REGISTRY NO: 7647-01-0

FORMULA: H-(Cl)

MOLECULAR WEIGHT: 36.46

COMPOUND CLASS: Inorganic acid

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -84.9

MELTING POINT, CELSIUS: -114.8

FLASH POINT, CELSIUS: NONFLAMM

SOLUBILITY, IN WATER: 823 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846, No. 0050 or 0051, Method 26

ANALYSIS METHOD:

SW-846, No.9057 (Ion chromatography)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 111

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hydrofluoric acid
Hydrogen fluoride

CAS REGISTRY NO: 7664-39-3

FORMULA: H-F

MOLECULAR WEIGHT: 20.01

COMPOUND CLASS: Inorganic acid

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 19.5

MELTING POINT, CELSIUS: -83.55

FLASH POINT, CELSIUS: Nonflamm

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Corrosive; toxic

SAMPLING METHOD: EPA Method 13A or 13B

ANALYSIS METHOD:

Ion chromatography--an alternate analysis procedure

VALIDATION STATUS:

Field validated at primary aluminum smelter.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

112

DATE OF LATEST ENTRY:

04/10/91

COMPOUND: Hydrogen sulfide

CAS REGISTRY NO: 7783-06-4

FORMULA: H₂-S

MOLECULAR WEIGHT: 34.08

COMPOUND CLASS:

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -60.33

MELTING POINT, CELSIUS: -85.49

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 4 g/l

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Extremely hazardous.

SAMPLING METHOD: Impinger

ANALYSIS METHOD:

Absorption - methylene blue - spectrophotometric

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Breakthrough

DESCRIPTION OF PROBLEMS:

Difficult to collect and preserve because of volatility.

SOLUTIONS:

RECORD NUMBER: 113

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Hydroquinone

CAS REGISTRY NO: 123-31-9

FORMULA: C6-H6-O2

MOLECULAR WEIGHT: 110.11

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 285

MELTING POINT, CELSIUS: 170

FLASH POINT, CELSIUS: 165

SOLUBILITY, IN WATER: 1 in 14 parts

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Relatively safe in low concentrations.

SAMPLING METHOD: SW-846 No. 0010 (MM5) or Draft Method No. 0011 (DNPH impinger)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS) or Draft Method No. 8315 HPLC)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Its solution becomes brown in air due to oxidation. The oxidation is very rapid in presence of alkali.

SOLUTIONS:

Keep well closed and protected from light.

RECORD NUMBER: 389

DATE OF LATEST ENTRY: 09/12/91

COMPOUND: Iodomethane
Methyl iodide

CAS REGISTRY NO: 74-88-4

FORMULA: C-H3-I

MOLECULAR WEIGHT: 141.95

COMPOUND CLASS: Iodinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 210

BOILING POINT, CELSIUS: 42.5

MELTING POINT, CELSIUS: -66

FLASH POINT, CELSIUS: NONFLAMM

SOLUBILITY, IN WATER: Sol in about 50 parts of water

HEAT OF COMBUSTION, KCAL/MOLE: 105.93

COMBUSTION RANKING: 119

TOXICITY DATA: Highly toxic; cancer suspect agent

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:

Turns brown on exposure to light.

Decomposes at 270 degrees centigrade.

Caution--watch temperatures in port area.

SOLUTIONS:

Protect from light.

Do not heat above 265 degrees centigrade.

Caution--watch temp in port area.

RECORD NUMBER: 114 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Isophorone
3,5,5-Trimethyl-2-cyclohexene-1-one

CAS REGISTRY NO: 78-59-1

FORMULA: C9-H14-O

MOLECULAR WEIGHT: 138.21

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 213

MELTING POINT, CELSIUS: -8

FLASH POINT, CELSIUS: 84.00

SOLUBILITY, IN WATER: 12 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 124.1

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity. Skin and eye irritant. Kidney poison.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

This compound is incompatible with strong oxidizers.

SOLUTIONS:

RECORD NUMBER: 115 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Lead and compounds, N.O.S.
Lead

CAS REGISTRY NO: 7439-92-1

FORMULA: Pb

MOLECULAR WEIGHT: 207.10

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 1740

MELTING POINT, CELSIUS: 327.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Toxic

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Mult. metals train), EPA Method

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-atomic spectroscopy)

VALIDATION STATUS:

For method evaluation, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors", Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL, April, 1989.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

116

DATE OF LATEST ENTRY:

04/10/91

COMPOUND:

Lindane

1,2,3,4,5,6-Hexachlorocyclohexane

gamma-BHC (aka benzene hexachloride, a misnomer)

CAS REGISTRY NO: 58-89-9

FORMULA:

MOLECULAR WEIGHT: 290.83

COMPOUND CLASS: Chlorinated Insecticide

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 323.4

MELTING POINT, CELSIUS: 114

FLASH POINT, CELSIUS: NONFLAMM

SOLUBILITY, IN WATER: 17.0 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity. May cause death.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8081 or 8270 (Extraction- GC/ECD or GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

When heated to decomposition, this compound emits toxic phosgene fumes.

SOLUTIONS:

Do not heat to decomposition.

RECORD NUMBER: 117 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Maleic anhydride
2,5-Furandione

CAS REGISTRY NO: 108-31-6
FORMULA: C4-H2-O3
MOLECULAR WEIGHT: 98.06
COMPOUND CLASS: Anhydride
APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3
UDRI THERMAL STABILITY RANKING: 98

BOILING POINT, CELSIUS: 202
MELTING POINT, CELSIUS: 52.8
FLASH POINT, CELSIUS: 103
SOLUBILITY, IN WATER: Sol

HEAT OF COMBUSTION, KCAL/MOLE: 332.10
COMBUSTION RANKING: 90

TOXICITY DATA: Powerful irritant; causes severe burns.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV).

VALIDATION STATUS:
For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Hazardous
Sampling

SPECIFIC PROBLEM TYPE(S): Explosive
Reactive

DESCRIPTION OF PROBLEMS:
Reacts with water to yield maleic acid.

Decomposition or polymerization explosion can occur in presence of alkali or alkaline earth metal ions, ammonium ions or amines when heated above 150 C. Caution--watch temperature in port area.

Maleic anhydride is a product of incomplete combustion of 1-butene.

SOLUTIONS:
Store in dry well-ventilated location and away from alkalis, amines, and oxidizing agents. For trial burn purposes it is possible to sample maleic anhydride with SW-846 Method 0010 (converting to maleic acid in the sampling process) and then analyze for maleic acid and report maleic acid as maleic anhydride. This approach produces a "worse case" D.R.E., since any maleic acid present also gets added into the total amount.

RECORD NUMBER: 411

DATE OF LATEST ENTRY: 09/12/91

COMPOUND: Manganese

CAS REGISTRY NO: 7439-96-5

FORMULA: Mn

MOLECULAR WEIGHT: 54.94

COMPOUND CLASS: Metal

APPENDIX 8? N

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 1962

MELTING POINT, CELSIUS: 1244

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Highly toxic through inhalation.

SAMPLING METHOD: SW-846, Draft No. 0012, (Multiple Metals Train)

ANALYSIS METHOD:

SW-846 No. 6010

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 118 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Mercury and compounds, N.O.S.
Mercury

CAS REGISTRY NO: 7439-97-6

FORMULA: Hg

MOLECULAR WEIGHT: 200.59

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 357

MELTING POINT, CELSIUS: -38.8

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.28 umoles/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train) or EPA 1

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Atomic Absorption Spectroscopy)

VALIDATION STATUS:

For method evaluation, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors" Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL, April (1989).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 119

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methanol
Methyl alcohol

CAS REGISTRY NO: 67-56-1

FORMULA: C-H4-O

MOLECULAR WEIGHT: 32.04

COMPOUND CLASS: Alcohol

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 64.6

MELTING POINT, CELSIUS: -98

FLASH POINT, CELSIUS: 11.00

SOLUBILITY, IN WATER: Soluble

HEAT OF COMBUSTION, KCAL/MOLE: 173.6

COMBUSTION RANKING:

TOXICITY DATA: Low toxicity via oral and skin. Moderate via inhalation.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water soluble

DESCRIPTION OF PROBLEMS:

Highly water soluble, therefore likely to purge poorly.

SOLUTIONS:

RECORD NUMBER: 120

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methoxychlor

CAS REGISTRY NO: 72-43-5

FORMULA: C16-H15-(Cl)3-O2

MOLECULAR WEIGHT: 345.65

COMPOUND CLASS: Organochlorine pesticide

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 243

BOILING POINT, CELSIUS: DECOMP

MELTING POINT, CELSIUS: 78

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Practically insol in water

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Continued ingestion over long periods may cause kidney damage.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER:

121

DATE OF LATEST ENTRY: 12/26/90

COMPOUND: 4,4'-Methylenebis(2-chloroaniline)
4,4'-Methylenebis(o-chloroaniline)

CAS REGISTRY NO: 101-14-4

FORMULA: C13-H12-(Cl)2-N2

MOLECULAR WEIGHT: 267.17

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 211

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 99

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV).

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Analysis
Analysis

SPECIFIC PROBLEM TYPE(S): Chromatography
Interference

DESCRIPTION OF PROBLEMS:

Several amines interfere because they have the same retention times.

SOLUTIONS:

The interferences were eliminated by changing the composition of the HPLC mobile phase.

RECORD NUMBER: 122 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: 4,4-Methylenedianiline
p,p'-Methylenedianiline
4,4'-DIAMINODIPHENYLMETHANE

CAS REGISTRY NO: 101-77-9

FORMULA: C13-H14-N2

MOLECULAR WEIGHT: 198.27

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 398-399

MELTING POINT, CELSIUS: 90

FLASH POINT, CELSIUS: 221.00

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Toxic

DESCRIPTION OF PROBLEMS:

Compound may be reactive during sampling (experiments are needed), When heated to decomposition, this compound emits highly toxic aniline fumes.

SOLUTIONS:

Dynamic spiking and recovery.

Do not heat to decomposition.

RECORD NUMBER: 123 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methylene diphenyl diisocyanate
MDI
Methylenebis(4-phenyl isocyanate)

CAS REGISTRY NO: 101-68-8

FORMULA: C15-H10-O2-N2

MOLECULAR WEIGHT: 250.2

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 196 @ 5mm

MELTING POINT, CELSIUS: 37.2

FLASH POINT, CELSIUS: 202

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

HPLC

VALIDATION STATUS:

No validated stack method.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Compound reacts with water during sampling.

SOLUTIONS:

For derivatization HPLC method, see "Determination of Isocyanates in Working Atmospheres by High Speed Liquid Chromatography". Analytical Chem. 48, 497-499 (1976).

Compound must be derivatized during sampling. Method is under development.

RECORD NUMBER: 124

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methyl ethyl ketone
Butanone

CAS REGISTRY NO: 78-93-3

FORMULA: C4-H8-O

MOLECULAR WEIGHT: 72.12

COMPOUND CLASS: Ketone

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 108

BOILING POINT, CELSIUS: 79.6

MELTING POINT, CELSIUS: -86.35

FLASH POINT, CELSIUS: -9

SOLUBILITY, IN WATER: Very sol

HEAT OF COMBUSTION, KCAL/MOLE: 584.17

COMBUSTION RANKING: 64

TOXICITY DATA: Irritant; flammable liquid

SAMPLING METHOD: SW-846 No. 0030 (VOST) or Draft Method No. 0011 (DNPH Imping.

ANALYSIS METHOD:

SW-846 No. 5040 (Therm Desorp/Purge and Trap-GC/MS) or Draft 8315

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water Soluble

DESCRIPTION OF PROBLEMS:

Very soluble in water, and therefore is likely to be present in the condensate trap of the sampling train.

Validation studies have shown that MEK can be recovered using modified analysis procedures. See "Development of VOST Sample Analysis Protocol for Water-Soluble Volatile POHCs and PICs." (EPA-600/8-87-008 February 1987)

SOLUTIONS:

A longer purge time might be necessary for adequate recovery. Also, the extract from the condensate liquid should be analyzed by GC/MS.

RECORD NUMBER: 125 DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Methylhydrazine

CAS REGISTRY NO: 60-34-4

FORMULA: C-H6-N2

MOLECULAR WEIGHT: 46.09

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 197

BOILING POINT, CELSIUS: 87.5

MELTING POINT, CELSIUS: -80

FLASH POINT, CELSIUS: 70.00

SOLUBILITY, IN WATER: Sol

HEAT OF COMBUSTION, KCAL/MOLE: 311.95

COMBUSTION RANKING: 92

TOXICITY DATA: Highly toxic; cancer suspect agent

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Therm Desorp/Purge and Trap-GC/MS) or Draft 5041

VALIDATION STATUS:

For GC/FID analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Water Soluble

DESCRIPTION OF PROBLEMS:

Soluble in water, and therefore is likely to be present in the condensate trap of the sampling train.

SOLUTIONS:

A longer purge time might be necessary for adequate recovery. Also, the extract from the condensate liquid should be analyzed by GC/MS.

RECORD NUMBER: 126 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methyl isobutyl ketone
4-Methyl-2-Pentanone

CAS REGISTRY NO: 108-10-1

FORMULA: C6-H12-O

MOLECULAR WEIGHT: 100.16

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 117.5

MELTING POINT, CELSIUS: -80

FLASH POINT, CELSIUS: 13.00

SOLUBILITY, IN WATER: 19 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 580.9

COMBUSTION RANKING:

TOXICITY DATA: Eye irritant. Moderate toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No.8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Water solubility

DESCRIPTION OF PROBLEMS:

This compound presents a dangerous fire hazard. It can react vigorously with reducing materials.

SOLUTIONS:

Adequate extraction and recovery must be demonstrated.

RECORD NUMBER:

127

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Methyl methacrylate

CAS REGISTRY NO: 80-62-6

FORMULA: C5-H8-O2

MOLECULAR WEIGHT: 100.13

COMPOUND CLASS: Aliphatic ester

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 60

BOILING POINT, CELSIUS: 100

MELTING POINT, CELSIUS: -48

FLASH POINT, CELSIUS: 10

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE: 631.8

COMBUSTION RANKING:

TOXICITY DATA: Flammable liquid; lachrymator

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Therm Desorp/Purge and Trap-GC/MS) or Draft 5041

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Polymerization may be a problem.

SOLUTIONS:

Compound recovery should be checked.

RECORD NUMBER: 128 DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Methyl tert-butyl ether

CAS REGISTRY NO: 1634-04-4

FORMULA: C5-H12-O

MOLECULAR WEIGHT: 88.15

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 55.2

MELTING POINT, CELSIUS: -109

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Soluble

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Explosive

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 129

DATE OF LATEST ENTRY: 09/27/90

COMPOUND: Mineral fibers

CAS REGISTRY NO:

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 130

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Naphthalene
Mothball

CAS REGISTRY NO: 91-20-3

FORMULA: C10-H8

MOLECULAR WEIGHT: 128.18

COMPOUND CLASS: PAH

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 5

BOILING POINT, CELSIUS: 217.9

MELTING POINT, CELSIUS: 80.2

FLASH POINT, CELSIUS: 79.00

SOLUBILITY, IN WATER: INSOL 30 mg/l

HEAT OF COMBUSTION, KCAL/MOLE: 1230.00

COMBUSTION RANKING: 25

TOXICITY DATA: Poisoning may occur by ingestion of large doses, or inhalation.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 NO. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

The MM5 Method for naphthalene was validated in the lab and in the field.

See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074, (1987) and

"Laboratory and Field Evaluation of the Semi-VOST Method"

(EPA-600/4-85-075a).

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 2 (EPA-600/8-87-037c).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 131 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Nickel and compounds, N.O.S.
Nickel

CAS REGISTRY NO: 7440-02-0

FORMULA: Ni

MOLECULAR WEIGHT: 58.71

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 2837

MELTING POINT, CELSIUS: 1555

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple metals train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic spectroscopy)

VALIDATION STATUS:

For method evaluation, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors", Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL, April, 1989.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 132

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Nitrobenzene

CAS REGISTRY NO: 98-95-3

FORMULA: C6-H5-N-O2

MOLECULAR WEIGHT: 123.12

COMPOUND CLASS:

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 143

BOILING POINT, CELSIUS: 210.8 (at 760 mm)

MELTING POINT, CELSIUS: 5.7

FLASH POINT, CELSIUS: 88.00

SOLUBILITY, IN WATER: Sol in about 500 parts water.

HEAT OF COMBUSTION, KCAL/MOLE: 739.20

COMBUSTION RANKING: 51

TOXICITY DATA: Rapidly absorbed through the skin; vapor hazardous; poisonous

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

The MM5 method was validated both in the lab and in the field for nitrobenzene. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074 (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a).

GENERAL PROBLEM TYPE(S): Hazardous
Hazardous

SPECIFIC PROBLEM TYPE(S): Explosive
Incompatibility

DESCRIPTION OF PROBLEMS:

Forms explosive mixtures with aluminum chloride, aniline, glycerine mixtures, nitric acid, nitrogen tetroxide, and silver perchlorate. Incompatible with caustic and reactive metals.

SOLUTIONS:

RECORD NUMBER: 133

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: 4-Nitrobiphenyl
Nitrobiphenyl

CAS REGISTRY NO: 92-93-3

FORMULA: C12-H9-N-O2

MOLECULAR WEIGHT: 199.21

COMPOUND CLASS: Nitro aromatic

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 340

MELTING POINT, CELSIUS: 113

FLASH POINT, CELSIUS: 179.00

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE: 688.8

COMBUSTION RANKING: .

TOXICITY DATA: Moderate toxicity via oral route. Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis
Sampling

SPECIFIC PROBLEM TYPE(S): Decomposition
Blank

DESCRIPTION OF PROBLEMS:

Sampling problem- This compound may form from reactions of PAH and NOx/HNO3 in combustion effluent either in the gas phase or on silica or alumina bearing particles. Its occurrence may be the result of reaction on the sampling media.

Analysis problem- Decomposition may occur in GC injection port.

SOLUTIONS:

1. May require cool on-column injection with a fused silica-bonded phase capillary column.
2. Alternate method - HPLC/UV, or HPLC/MS.

RECORD NUMBER: 134

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: 4-Nitrophenol

CAS REGISTRY NO: 100-02-7

FORMULA: C6-H5-N-O3

MOLECULAR WEIGHT: 139.12

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 148

BOILING POINT, CELSIUS: 279

MELTING POINT, CELSIUS: 114.9

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 16 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 688.80

COMBUSTION RANKING: 56

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS) Alternate method-HPLC/UV.

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 135

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: 2-Nitropropane

CAS REGISTRY NO: 79-46-9

FORMULA: C3-H7-N-O2

MOLECULAR WEIGHT: 89.09

COMPOUND CLASS: Flammable liquid

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 120

MELTING POINT, CELSIUS: -93

FLASH POINT, CELSIUS: 37.00

SOLUBILITY, IN WATER: 1.7%

HEAT OF COMBUSTION, KCAL/MOLE: 477.9

COMBUSTION RANKING:

TOXICITY DATA: Experimental carcinogen. Mod toxicity via oral and inhalation.

SAMPLING METHOD: SW-846 No. 0010 or 0030 (MM5 or VOST)

ANALYSIS METHOD:

SW-846 No. 8270 or 5040

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Breakthrough
Explosive

DESCRIPTION OF PROBLEMS:

This compound may explode upon heating. Heat decomposition emits highly toxic NOx fumes.

SOLUTIONS:

RECORD NUMBER:

136

DATE OF LATEST ENTRY:

09/25/90

COMPOUND: N-Nitrosodimethylamine

CAS REGISTRY NO: 62-75-9

FORMULA: C2-H6-N2-O

MOLECULAR WEIGHT: 74.10

COMPOUND CLASS: Nitrosamine

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 7

UDRI THERMAL STABILITY RANKING: 303

BOILING POINT, CELSIUS: 153 774

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: 61.00

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Chromatography

DESCRIPTION OF PROBLEMS:

Not retained on reversed phase HPLC column

SOLUTIONS:

RECORD NUMBER: 137

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: N-Nitroso-N-methylurea

CAS REGISTRY NO: 684-93-5

FORMULA: C2-H5-N3-O2

MOLECULAR WEIGHT: 103.10

COMPOUND CLASS: Nitrosamine

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 7

UDRI THERMAL STABILITY RANKING: 303

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 123 decomp

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 1.4%

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS) or Extraction, HPLC/UV

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Chromatography

DESCRIPTION OF PROBLEMS:

Unstable on GC column

Not retained on reversed phase HPLC column

SOLUTIONS:

RECORD NUMBER: 138

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: N-Nitrosomorpholine

CAS REGISTRY NO: 59-89-2

FORMULA: C4-H8-N2-O2

MOLECULAR WEIGHT: 116.14

COMPOUND CLASS: Nitrosamine

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 7

UDRI THERMAL STABILITY RANKING: 303

BOILING POINT, CELSIUS: 139

MELTING POINT, CELSIUS: 29

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Chromatography

DESCRIPTION OF PROBLEMS:

Unstable on GC column

Not retained on reversed phase HPLC column

SOLUTIONS:

RECORD NUMBER: 139 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Parathion
Thiophos
Parathion-ethyl

CAS REGISTRY NO: 56-38-2

FORMULA: C10-H14-N-O5-P-S

MOLECULAR WEIGHT: 291.28

COMPOUND CLASS: Organophosphate pesticide

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 222

BOILING POINT, CELSIUS: 375 (at 760 mm)

MELTING POINT, CELSIUS: 6.1

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Practically insol 24 mg/L

HEAT OF COMBUSTION, KCAL/MOLE: 1497.2

COMBUSTION RANKING:

TOXICITY DATA: Highly toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 140

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Pentachloronitrobenzene
PCNB

CAS REGISTRY NO: 82-68-8

FORMULA: C6-(Cl)5-N-O2

MOLECULAR WEIGHT: 295.32

COMPOUND CLASS: Chlorinated aromatic hydrocarbon

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 235

BOILING POINT, CELSIUS: 328 (at 760 mm)

MELTING POINT, CELSIUS: 140

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.44 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 141

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Pentachlorophenol
PCP

CAS REGISTRY NO: 87-86-5

FORMULA: C₆H-(Cl)₅O

MOLECULAR WEIGHT: 266.32

COMPOUND CLASS: Phenol, herbicide

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 151

BOILING POINT, C/°F: 309 (at 754 mm)

MELTING POINT, CELSIUS: 190

FLASH POINT, CELSIUS: nonflamm

SOLUBILITY, IN WATER: Almost insol 0.02 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 557.00

COMBUSTION RANKING: 67

TOXICITY DATA: Highly toxic; irritant

SAMPLING METHOD: SW-846 NO. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

Validation studies were inconclusive. The MM5 method is probably sufficient. Poor precision during the validation may have been caused by the inability to generate a test atmosphere reproducibly. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074, (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 142

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Phenol
Carbolic acid

CAS REGISTRY NO: 108-95-2

FORMULA: C6-H6-O

MOLECULAR WEIGHT: 94.12

COMPOUND CLASS: Phenol

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 3

UDRI THERMAL STABILITY RANKING: 101

BOILING POINT, CELSIUS: 181

MELTING POINT, CELSIUS: 43

FLASH POINT, CELSIUS: 79.00

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE: 730.00

COMBUSTION RANKING: 52

TOXICITY DATA: Highly toxic

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

The MM5 method was validated for phenol both in the lab and in the field. See "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074 (1987) and "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a).

For an alternate method using HPLC/UV, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 1 (EPA-600/8-87-037a).

GENERAL PROBLEM TYPE(S): Hazardous
Analysis

SPECIFIC PROBLEM TYPE(S): Toxic
Recovery

DESCRIPTION OF PROBLEMS:

Recovery from water is often poor. pH of the extraction is critical. The method must be validated.

SOLUTIONS:

Monitoring of pH during extraction is critical. Second solvent may be necessary for good recovery.

RECORD NUMBER: 143

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: p-Phenylenediamine
p-Diamine benzene
1,4-Diamine benzene

CAS REGISTRY NO: 106-50-3

FORMULA: C6-H8-N2

MOLECULAR WEIGHT: 108.14

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 267

MELTING POINT, CELSIUS: 146

FLASH POINT, CELSIUS: 156

SOLUBILITY, IN WATER: 4.7%

HEAT OF COMBUSTION, KCAL/MOLE: 843.4

COMBUSTION RANKING:

TOXICITY DATA: High toxicity. Powerful skin irritant.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Heat decomposition emits toxic NOx fumes.

SOLUTIONS:

RECORD NUMBER: 144 DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Phosgene
Carbonyl chloride

CAS REGISTRY NO: 75-44-5

FORMULA: C-(Cl)₂-O

MOLECULAR WEIGHT: 98.91

COMPOUND CLASS: Ketone

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 39

BOILING POINT, CELSIUS: 7.56 (at 760 mm)

MELTING POINT, CELSIUS: -118

FLASH POINT, CELSIUS: nonflamm

SOLUBILITY, IN WATER: Slightly

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Produces toxic and corrosive fumes

SAMPLING METHOD: Impinger, derivatization solution

ANALYSIS METHOD:

HPLC/UV, GC/FID or GC/MS

VALIDATION STATUS:

No validated method available.

GENERAL PROBLEM TYPE(S): Hazardous
Sampling

SPECIFIC PROBLEM TYPE(S): Toxic
Reactive

DESCRIPTION OF PROBLEMS:

Phosgene decomposes. It is also a highly toxic compound.

SOLUTIONS:

A NIOSH method uses collection with a solution of 4,4'-nitrobenzyl pyridine in diethyl phthalate. The exposed solution is analyzed spectrophotometrically. It would be more desirable to analyze the product by HPLC, but a method has not yet been developed. An alternate approach (Am. Ind. Hyg. Assoc. J. 47, pg 742, 1986) uses XAD-2 treated with di-n-butylamine for collection followed by a GC/FID method. This method has more promise for stack testing unless an HPLC or GC/MS method is developed.

RECORD NUMBER: 145

DATE OF LATEST ENTRY: 04/10/91

COMPOUND: Phosphine

CAS REGISTRY NO: 7803-51-2

FORMULA: P-H3

MOLECULAR WEIGHT: 34.00

COMPOUND CLASS:

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -87.7

MELTING POINT, CELSIUS: -133

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Slightly

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: Gas Sample Bag or SW-846 Draft Method No. 0012 (M. Metals Trai

ANALYSIS METHOD:

GC/FPD or SW-846 Draft No. 0012 (Atomic Spectroscopy)

VALIDATION STATUS:

For method evaluation for total phosphorus, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors", Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL, April 1989.

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Interference

DESCRIPTION OF PROBLEMS:

Draft Method 0012 yields total Phosphorus. Bag method has not been validated.

SOLUTIONS:

Bag method should be evaluated before use. Draft Method 0012 can be used for "worst case".

RECORD NUMBER: 146 DATE OF LATEST ENTRY: 12/31/90

COMPOUND: Phosphorus (white or yellow)
Phosphorus

CAS REGISTRY NO: 7723-14-0

FORMULA: P₄

MOLECULAR WEIGHT: 123.90

COMPOUND CLASS: Flammable solid, Poison

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 280

MELTING POINT, CELSIUS: 44.1

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.0003%

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity. Can remove O₂ from air. Extreme irritant.

SAMPLING METHOD: SW-846, Draft No, 0012, (Multiple Metals Train)

ANALYSIS METHOD:

SW-846 No. 6010

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Explosive

DESCRIPTION OF PROBLEMS:

This compound presents a very dangerous fire and explosion hazard. It undergoes spontaneous combustion when in contact with air.

Method 0012 yields only total P. Elemental P cannot be discriminated from PO₄= etc by this method.

SOLUTIONS:

RECORD NUMBER: 147

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Phthalic anhydride
Phthalandione

CAS REGISTRY NO: 85-44-9

FORMULA: C8-H4-O3

MOLECULAR WEIGHT: 148.12

COMPOUND CLASS: Anhydride

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 148

BOILING POINT, CELSIUS: 295

MELTING POINT, CELSIUS: 131.61

FLASH POINT, CELSIUS: 165

SOLUBILITY, IN WATER: 1000 PPM

HEAT OF COMBUSTION, KCAL/MOLE: 779.00

COMBUSTION RANKING: 48

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS or HPLC/UV).

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water Soluble

DESCRIPTION OF PROBLEMS:

Reacts with water to yield phthalic acid.
A common air contaminant.

SOLUTIONS:

For trial burn purposes it is possible to sample phthalic anhydride with SW-846 Method 0010 (converting to phthalic acid in the sampling process) and then analyze for phthalic acid and report phthalic acid as phthalic anhydride. This approach produces a "worse case" D.R.E., since any phthalic acid present also gets added into the total amount.

RECORD NUMBER:

148

DATE OF LATEST ENTRY:

09/25/90

COMPOUND: Polychlorinated biphenyl, N.O.S.

CAS REGISTRY NO: 1336-36-3

FORMULA: C12-Hx-(Cl)x

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No.0010 (Extraction-GC/MS) or No. 8081(Extraction, GC/ECD)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Complex Mixture

DESCRIPTION OF PROBLEMS:

These compounds are mixtures and are difficult to quantitate.

SOLUTIONS:

RECORD NUMBER: 149

DATE OF LATEST ENTRY: 09/27/90

COMPOUND: Polycyclic Organic Matter

CAS REGISTRY NO:

FORMULA:

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD:

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 150 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 1,3-Propane sultone

CAS REGISTRY NO: 1120-71-4

FORMULA: C3-H6-O3-S

MOLECULAR WEIGHT: 122.15

COMPOUND CLASS:

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 230

BOILING POINT, CELSIUS: 180 (at 30 mm)

MELTING POINT, CELSIUS: 31

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 100 G/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 2 (EPA-600/8-87-037c).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

150.a

RECORD NUMBER: 558

DATE OF LATEST ENTRY: 09/12/89

COMPOUND: Propene, 3-chloro-
Allyl chloride

CAS REGISTRY NO: 107-05-1

FORMULA: C3-H5-(Cl)

MOLECULAR WEIGHT: 76.53

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 45.1

MELTING POINT, CELSIUS: -134

FLASH POINT, CELSIUS: -32.00

SOLUBILITY, IN WATER: 100 mg/L

HEAT OF COMBUSTION, KCAL/MOLE: 440.80

COMBUSTION RANKING: 76

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 151

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: b-Propiolactone
beta-Propiolactone
2-oxetanone

CAS REGISTRY NO: 57-57-8

FORMULA: C3-H4-O2

MOLECULAR WEIGHT: 72.06

COMPOUND CLASS: Human Carcinogen

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 162 DECOMP

MELTING POINT, CELSIUS: -33.4

FLASH POINT, CELSIUS: 70.0

SOLUBILITY, IN WATER: 37%

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis
Hazardous

SPECIFIC PROBLEM TYPE(S): Water Soluble
Incompatibility

DESCRIPTION OF PROBLEMS:

This compound, upon heat decomposition emits acrid smoke and fumes. It is incompatible with acetates, halogens, thiocyanates, and thiosulfates.

SOLUTIONS:

RECORD NUMBER: 152

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Propionaldehyde
Propyl aldehyde
Proponal

CAS REGISTRY NO: 123-38-6

FORMULA: C3-H6-O

MOLECULAR WEIGHT: 58.08

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 48

MELTING POINT, CELSIUS: -81

FLASH POINT, CELSIUS: -26.00

SOLUBILITY, IN WATER: 200 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 0.002

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity.

SAMPLING METHOD: DNPH impinger

ANALYSIS METHOD:

HPLC/UV

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

Derivatized with 2,4-dinitrophenylhydrazine

RECORD NUMBER: 153

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Propoxur
Baygon

CAS REGISTRY NO: 114-26-1

FORMULA: C11-H15-N-O3

MOLECULAR WEIGHT: 209.24

COMPOUND CLASS: Carbamate Pesticide

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS:

MELTING POINT, CELSIUS: 91.5

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.2%

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8318 (HPLC/UV)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Heat decomposition of this compound emits highly toxic NOx fumes. It is unstable in alkaline media.

SOLUTIONS:

RECORD NUMBER: 154 DATE OF LATEST ENTRY: 09/28/90

COMPOUND: 1,2-Propyleneimine
2-Methylaziridine

CAS REGISTRY NO: 75-55-8

FORMULA: C3-H7-N

MOLECULAR WEIGHT: 57.10

COMPOUND CLASS: Flammable Liquid.

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 243

BOILING POINT, CELSIUS: 66

MELTING POINT, CELSIUS: -65

FLASH POINT, CELSIUS: -15.00

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE: 9.09

COMBUSTION RANKING: 124

TOXICITY DATA: High toxicity. An experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Heat decomposition of this compound emits toxic fumes of NOx. It can react with oxidizing materials.

SOLUTIONS:

RECORD NUMBER: 155

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Propylene oxide
1,2-propylene oxide

CAS REGISTRY NO: 75-56-9

FORMULA: C3-H6-O

MOLECULAR WEIGHT: 58.08

COMPOUND CLASS: Flammable Liquid.

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 34.23

MELTING POINT, CELSIUS: -112

FLASH POINT, CELSIUS: -37.00

SOLUBILITY, IN WATER: 20%

HEAT OF COMBUSTION, KCAL/MOLE: 0.124

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity via oral, inhalation, & dermal route.

SAMPLING METHOD: Tedlar bag or SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water Soluble

DESCRIPTION OF PROBLEMS:

A severe explosion hazard when exposed to flame. Can react violently with oxidizing materials.

SOLUTIONS:

RECORD NUMBER: 156

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Quinoline

CAS REGISTRY NO: 91-22-5

FORMULA: C9-H7-N

MOLECULAR WEIGHT: 129.16

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 113.5

MELTING POINT, CELSIUS: -15

FLASH POINT, CELSIUS: 101.0

SOLUBILITY, IN WATER: 60 g/L

HEAT OF COMBUSTION, KCAL/MOLE: 1123.5

COMBUSTION RANKING:

TOXICITY DATA: High - moderate toxicity via oral and dermal routes.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

When heated to decomposition, this compound emits toxic fumes of NOx.

SOLUTIONS:

RECORD NUMBER: 157

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Quinone
1,4-Benzoquinone

CAS REGISTRY NO: 106-51-4

FORMULA: C6-H4-O2

MOLECULAR WEIGHT: 108.10

COMPOUND CLASS: Ketone

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: Sublimes

MELTING POINT, CELSIUS: 114

FLASH POINT, CELSIUS: 38-93

SOLUBILITY, IN WATER: SLIGHTLY

HEAT OF COMBUSTION, KCAL/MOLE: 656.6

COMBUSTION RANKING:

TOXICITY DATA: High toxicity. Vapors can cause cornea damage.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

HPLC/Electrochemical detector.

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Hazardous

SPECIFIC PROBLEM TYPE(S): Reactive
Toxic

DESCRIPTION OF PROBLEMS:

Incompatiable with strong oxidizers.

SOLUTIONS:

RECORD NUMBER: 158 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Radionuclides (including Radon)
Radon

CAS REGISTRY NO: 10043-92-2

FORMULA: Rn

MOLECULAR WEIGHT:

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: -618

MELTING POINT, CELSIUS: -71

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 224 CC/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: EPA Methods 111, 114, and 115

ANALYSIS METHOD:

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 159 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Selenium and compounds, N.O.S.
Selenium

CAS REGISTRY NO: 7782-49-2

FORMULA: Se

MOLECULAR WEIGHT: 78.96

COMPOUND CLASS: Metal

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 684.8

MELTING POINT, CELSIUS: 217

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 Draft Method No. 0012 (Multiple Metals Train)

ANALYSIS METHOD:

SW-846 Draft Method No. 0012 (Acid digestion-Atomic spectroscopy)

VALIDATION STATUS:

For method evaluation, see "Measurement Methodology for Toxic Metals from Municipal Waste Combustors", Paper 5C-1, International Conference on Municipal Waste Combustors, Hollywood, FL, April, 1989.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 160

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Styrene

CAS REGISTRY NO: 100-42-5

FORMULA: C8-H8

MOLECULAR WEIGHT: 104.15

COMPOUND CLASS: Aromatic hydrocarbon

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 145

MELTING POINT, CELSIUS: -31

FLASH POINT, CELSIUS: 31.00

SOLUBILITY, IN WATER: SPARINGLY

HEAT OF COMBUSTION, KCAL/MOLE: 1047.10

COMBUSTION RANKING: 29

TOXICITY DATA: Irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Blank
Blank

DESCRIPTION OF PROBLEMS:

The usual sorbent for Method 0010 is XAD-2 resin which is a styrene-divinylbenzene copolymer. Styrene monomer may also be present in the resin and may result in a blank problem.

SOLUTIONS:

A different sorbent should be substituted for XAD-2. Two possible candidates are Tenax, which would require extraction with pentane or hexane, and XAD-7, which is an acrylic resin. Extraction efficiencies need to be validated before these modifications are accepted.

RECORD NUMBER: 161

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Styrene oxide
1,2-Epoxyethylbenzene
Phenylethylene oxide

CAS REGISTRY NO: 96-09-3

FORMULA: C8-H8-O

MOLECULAR WEIGHT: 120.15

COMPOUND CLASS:

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 194

MELTING POINT, CELSIUS: -37

FLASH POINT, CELSIUS: 79.00

SOLUBILITY, IN WATER: 2.8 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity via inhalation. Experimental carcinogen.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Can react with oxidizing metals.

SOLUTIONS:

RECORD NUMBER: 162

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TCDD

CAS REGISTRY NO: 1746-01-6

FORMULA: C12-H4-(Cl)4-O2

MOLECULAR WEIGHT: 321.98

COMPOUND CLASS: Dioxin

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 34

BOILING POINT, CELSIUS: > 700

MELTING POINT, CELSIUS: 305

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: 0.2 UG/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5), Alt. EPA Draft Method 23

ANALYSIS METHOD:

SW-846 No. 8280, Draft 8290 (Extraction, GC/MS), EPA Draft 23

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 2 (EPA-600/8-87-037c).

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

May be highly toxic. Analysis is costly and difficult, often requiring high resolution GC/MS.

Also, extraction efficiency is suspect if carbon level of particulate is high.

SOLUTIONS:

Follow-up extraction and probe rinse with toluene may be necessary.

The use of EPA Draft Method 23 is required for Municipal Waste Incinerators, but contains less stringent spike recovery QC than method 0010. Thus it may not be completely acceptable for hazardous waste incinerator DRE determinations.

RECORD NUMBER: 163 DATE OF LATEST ENTRY: 06/13/91

COMPOUND. 1,1,2,2-Tetrachloroethane

CAS REGISTRY NO: 79-34-5

FORMULA: C2-H2-(Cl)4

MOLECULAR WEIGHT: 167.84

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 121

BOILING POINT, CELSIUS: 146.2 (at 760 mm)

MELTING POINT, CELSIUS: -36

FLASH POINT, CELSIUS: NON-FLAM

SOLUBILITY, IN WATER: Sparingly sol 3G/L

HEAT OF COMBUSTION, KCAL/MOLE: 233.00

COMBUSTION RANKING: 105

TOXICITY DATA: Powerful narcotic; liver poison

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

The MM5 method for this compound is fully validated, both in the lab and in the field. See "Laboratory and Field Evaluation of the Semi-VOST Method". (EPA/600/4-85/075a, Nov., 1985) and "An Evaluation of the Semi-VOST Method" JAPCA 37, 1067-1074, (1987).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 164

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Tetrachloroethylene
Perchloroethylene

CAS REGISTRY NO: 127-18-4

FORMULA: C2-(Cl)4

MOLECULAR WEIGHT: 165.80

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 36

BOILING POINT, CELSIUS: 121 (at 760 mm)

MELTING POINT, CELSIUS: -19

FLASH POINT, CELSIUS: NONE

SOLUBILITY, IN WATER: 150 MG/L

HEAT OF COMBUSTION, KCAL/MOLE: 199.00

COMBUSTION RANKING: 112

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST), SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, Draft Method 5041 or SW-846 No. 8270

VALIDATION STATUS:

VOST method has been validated for this compound. See "Validation Studies of the Protocol for the VOST", JAPCA 37, 388-394 (1987).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 165 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Tetrachloromethane
Carbon tetrachloride

CAS REGISTRY NO: 56-23-5

FORMULA: C-(Cl)₄

MOLECULAR WEIGHT: 153.84

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 136

BOILING POINT, CELSIUS: 77

MELTING POINT, CELSIUS: -23

FLASH POINT, CELSIUS: NON-FLAM

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

The VOST method has been validated for this compound (See "Validation Studies of the Protocol for the VOST", JAPCA Vol. 23, No. 4, 388-394, 1987). (Also see "Recovery of POHCs and PICs from a VOST", EPA-600/7-86-025.)

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Slightly soluble (0.08 g/100 g water)

SOLUTIONS:

RECORD NUMBER: 166

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Titanium tetrachloride
Titanium (IV) chloride

CAS REGISTRY NO: 7550-45-0

FORMULA: $\text{Ti}(\text{Cl})_4$

MOLECULAR WEIGHT: 189.71

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 136.4

MELTING POINT, CELSIUS: -24.1

FLASH POINT, CELSIUS: 7

SOLUBILITY, IN WATER: SOL

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity. Irritant to skin. Highly corrosive.

SAMPLING METHOD: M Metals train

ANALYSIS METHOD:

ICP AAS

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

This compound will react violently with potassium.

SOLUTIONS:

RECORD NUMBER: 167

DATE OF LATEST ENTRY: 09/25/90

COMPOUND: Toluene

CAS REGISTRY NO: 108-88-3

FORMULA: C7-H8

MOLECULAR WEIGHT: 92.15

COMPOUND CLASS: Aromatic hydrocarbon

APPENDIX 8? Y

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 35

BOILING POINT, CELSIUS: 110.6 (at 760 mm)

MELTING POINT, CELSIUS: -95

FLASH POINT, CELSIUS: 4.40

SOLUBILITY, IN WATER: Very slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 935.00

COMBUSTION RANKING: 33

TOXICITY DATA: Narcotic in high concentrations

SAMPLING METHOD: SW-846 No. 0030 (VOST) or SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, Draft Method 5041 or SW-846 No. 8270

VALIDATION STATUS:

This compound has been validated using both the VOST and MM5 trains. See "Recovery of Principal Organic Hazardous Constituents and Products of Incomplete Combustion from a Volatile Organic Sampling Train" (EPA-600/7-86-025). Also see "Laboratory and Field Evaluation of the Semi-VOST Method" (EPA-600/4-85-075a) and "An Evaluation of the Semi-VOST Method for Determining Emissions from Hazardous Waste Incinerators". JAPCA 37, 1067-1074, (1988).

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Blank

DESCRIPTION OF PROBLEMS:

Blank problem with Tenax, generally less severe than similar benzene problem. Toluene is a common PIC. This may complicate interpretation of results, and make it difficult to achieve acceptable DRE with low waste feed concentrations.

SOLUTIONS:

Level of lab blanks should be determined in advance. Calculations should be made based on waste feed concentration to determine if blanks level will be a significant problem. Toluene should not be chosen as a POHC at very low waste feed levels likely to make the blank for PIC problems significant. When sampling toluene with Method 0010 and analyzing by GC/MS, it is imperative that deuterated toluene be spiked before extraction in order to document recovery. The low boiling point of toluene makes it easy to lose during extraction and subsequent concentration steps.

RECORD NUMBER: 168 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Toluene diisocyanate

CAS REGISTRY NO: 584-84-9

FORMULA: C9-H6-N2-O2

MOLECULAR WEIGHT: 174.11

COMPOUND CLASS: Isocyanate

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 251 (at 760 mm)

MELTING POINT, CELSIUS: 19.5-21.5

FLASH POINT, CELSIUS: 132.00

SOLUBILITY, IN WATER: REACTS

HEAT OF COMBUSTION, KCAL/MOLE: 0.0329

COMBUSTION RANKING:

TOXICITY DATA: Cause allergic eczema and bronchial asthma

SAMPLING METHOD: Impinger

ANALYSIS METHOD:

HPLC/UV

VALIDATION STATUS:

No validated sampling method identified.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Reacts with water with evolution of carbon dioxide. Must be rapidly converted to stable derivatives to eliminate possibility of undesirable side reactions prior to analysis.

SOLUTIONS:

A nitro reagent absorber solution reacts with isocyanates to form stable urea derivatives which are detected by UV absorption at 254 nm after HPLC separation. See "Determination of Isocyanates in Working Atmospheres by High Speed Liquid Chromatography" Analytical Chemistry, 48, 497-499, (1976).

A status sheet on isocyanate sampling is available from the Source Methods Standardization Branch.

RECORD NUMBER: 169

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: o-Toluidine
2-AMINOTOLUENE

CAS REGISTRY NO: 95-53-4

FORMULA: C7-H9-N

MOLECULAR WEIGHT: 107.16

COMPOUND CLASS: Aromatic amine

APPENDIX 8? Y APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 200

MELTING POINT, CELSIUS: -28

FLASH POINT, CELSIUS: 85.00

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE: 964.30

COMBUSTION RANKING: 32

TOXICITY DATA: Highly toxic; irritant

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For HPLC/UV analysis method, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

169.a

RECORD NUMBER: 634 DATE OF LATEST ENTRY: 09/12/91

COMPOUND: p-Toluidine, alpha,alpha,alpha-trifluoro-2,6-dinitro-N,N-dipropyl
Trifluralin
Treflan

CAS REGISTRY NO: 1582-09-8
FORMULA: C13-H16-F3-N3-O4
MOLECULAR WEIGHT: 335.3
COMPOUND CLASS: PESTICIDE
APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:
UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 139.5
MELTING POINT, CELSIUS: 48.5
FLASH POINT, CELSIUS: NON-FLAM
SOLUBILITY, IN WATER: <1mg/L

HEAT OF COMBUSTION, KCAL/MOLE:
COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
HPLC/UV

VALIDATION STATUS:
Sampling method has not been validated. Analysis method not identified but should be available because compound is a commercial herbicide.

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 170 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Toxaphene
Chlorinated Camphene

CAS REGISTRY NO: 8001-35-2
FORMULA: C10-H10-(Cl)8
MOLECULAR WEIGHT: 413.80
COMPOUND CLASS: Organochlorine pesticide
APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:
UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 155 DECOMP
MELTING POINT, CELSIUS: 65-90
FLASH POINT, CELSIUS: 135
SOLUBILITY, IN WATER: 3 MG/L

HEAT OF COMBUSTION, KCAL/MOLE:
COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:
SW-846 No. 8270 or 8250 (Extraction, GC/MS) or 8080 (GC/ECD)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Analysis

SPECIFIC PROBLEM TYPE(S): Decomposition

DESCRIPTION OF PROBLEMS:
Decomposes at 155 degrees centigrade.
Caution--watch temperature in port area.
This is a multicomponent analyte.

SOLUTIONS:

RECORD NUMBER: 171

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 1,2,4-Trichlorobenzene

CAS REGISTRY NO: 120-82-1

FORMULA: C6-H3-(Cl)3

MOLECULAR WEIGHT: 181.40

COMPOUND CLASS: Chlorinated aromatic hydrocarbon

APPENDIX 8? Y APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 1

UDRI THERMAL STABILITY RANKING: 26

BOILING POINT, CELSIUS: 213.5 (at 760 mm)

MELTING POINT, CELSIUS: 16.95

FLASH POINT, CELSIUS: 110.00

SOLUBILITY, IN WATER: INSOL 19 PPM

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 or 8250 (Extraction, GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 172 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 1,1,1-Trichloroethane
Methyl Chloroform

CAS REGISTRY NO: 71-55-6

FORMULA: C2-H3-(Cl)3

MOLECULAR WEIGHT: 133.40

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 5

UDRI THERMAL STABILITY RANKING: 201

BOILING POINT, CELSIUS: 74.1 (at 760 mm)

MELTING POINT, CELSIUS: -30.41

FLASH POINT, CELSIUS: NONE

SOLUBILITY, IN WATER: INSOL

HEAT OF COMBUSTION, KCAL/MOLE: 0.0195

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal Desorption/Purge and Trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Hazardous

SPECIFIC PROBLEM TYPE(S): Toxic

DESCRIPTION OF PROBLEMS:

Decomposes at high temperature or under ultraviolet radiation to produce toxic and corrosive materials such as phosgene and hydrogen chloride.

SOLUTIONS:

RECORD NUMBER: 173

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 1,1,2-Trichloroethane

CAS REGISTRY NO: 79-00-5

FORMULA: C2-H3-(Cl)3

MOLECULAR WEIGHT: 133.40

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 158

BOILING POINT, CELSIUS: 113.8 (at 760 mm)

MELTING POINT, CELSIUS: -36.50

FLASH POINT, CELSIUS: NONE

SOLUBILITY, IN WATER: Insol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0030 (VOST) or No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 5040, Draft Method 5041 or SW-846 No. 8270

VALIDATION STATUS:

Recovery from the VOST train has been demonstrated. See "Development of the VOST for use in Determining Incinerator Efficiency", Hazardous and Industrial Solid Waste Testing; Fourth Symposium, ASTM STP 886, pp. 335-343. (1986).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 174 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: Trichloroethene
Trichloroethylene

CAS REGISTRY NO: 79-01-6

FORMULA: C₂H-(Cl)₃

MOLECULAR WEIGHT: 131.38

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 41

BOILING POINT, CELSIUS: 87 (at 760 mm)

MELTING POINT, CELSIUS: -73

FLASH POINT, CELSIUS: NON-FLAM

SOLUBILITY, IN WATER: 1.1 MG/L

HEAT OF COMBUSTION, KCAL/MOLE: 229.00

COMBUSTION RANKING: 108

TOXICITY DATA: Slightly sol

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 or Draft 5041 (Therm Desorp/Purge and Trap-GC/MS)

VALIDATION STATUS:

Recovery from VOST train has been demonstrated. See "Development of the VOST for use in Determining Incinerator Efficiency", Hazardous and Industrial Solid Waste Testing: Fourth Symposium, ASTM STP 886 pp. 335-343 (1986) and "Recovery of POHCs and PICs from a VOST", EPA-600/7-86-025.

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Slightly soluble

SOLUTIONS:

RECORD NUMBER: 175

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 2,4,5-Trichlorophenol

CAS REGISTRY NO: 95-95-4

FORMULA: C6-H3-(Cl)3-O

MOLECULAR WEIGHT: 197.44

COMPOUND CLASS: Phenol

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 121

BOILING POINT, CELSIUS: 253 (at 760 mm)

MELTING POINT, CELSIUS: 68

FLASH POINT, CELSIUS: NON-FLAM

SOLUBILITY, IN WATER: 1.2 G/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA:

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID, GC/MS, and HPLC/UV analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Parts 1 and 2 (EPA-600/8-87-037a and EPA-600/3-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 176

DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 2,4,6-Trichlorophenol

CAS REGISTRY NO: 88-06-2

FORMULA: C6-H3-(Cl)3-O

MOLECULAR WEIGHT: 197.44

COMPOUND CLASS: Phenol

APPENDIX 8? Y

APPENDIX 9? Y

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 4

UDRI THERMAL STABILITY RANKING: 121

BOILING POINT, CELSIUS: 246 (at 760 mm)

MELTING POINT, CELSIUS: 69.5

FLASH POINT, CELSIUS: NON-FLAM

SOLUBILITY, IN WATER: 0.8 G/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Cancer suspect agent

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction, GC/MS)

VALIDATION STATUS:

For GC/FID and GC/MS analysis methods, see "POHC Analysis Methods for Hazardous Waste Incineration" Vol. 1, Part 2 (EPA-600/8-87-037b).

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

SOLUTIONS:

RECORD NUMBER: 177

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Triethylamine

CAS REGISTRY NO: 121-44-8

FORMULA: C6-H15-N

MOLECULAR WEIGHT: 101.19

COMPOUND CLASS: Amine

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 89.5

MELTING POINT, CELSIUS: -115

FLASH POINT, CELSIUS: -6

SOLUBILITY, IN WATER: 5.5%

HEAT OF COMBUSTION, KCAL/MOLE: 1036.8

COMBUSTION RANKING:

TOXICITY DATA: High toxicity via oral & inhalation routes. Moderate via skin.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling
Analysis

SPECIFIC PROBLEM TYPE(S): Reactive
Water Soluble

DESCRIPTION OF PROBLEMS:

Compound is soluble in water. Therefore purge efficiency may be poor.

SOLUTIONS:

Keep away from heat or open flame.

RECORD NUMBER: 178 DATE OF LATEST ENTRY: 06/13/91

COMPOUND: 2,2,4-Trimethylpentane
Isooctane

CAS REGISTRY NO: 540-84-1

FORMULA: $(\text{CH}_3)_2\text{-C-H-C-H}_2\text{-C}(\text{CH}_3)_3$

MOLECULAR WEIGHT: 114.23

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 98.5

MELTING POINT, CELSIUS: -107

FLASH POINT, CELSIUS: -7.00

SOLUBILITY, IN WATER: Insol.

HEAT OF COMBUSTION, KCAL/MOLE: 1303.9

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity via oral and inhalation routes.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Thermal desorption/purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Highly flammable, keep away from heat and open flame. This compound can react violently with reducing materials.

SOLUTIONS:

RECORD NUMBER: 179

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Vinyl acetate
Ethenylethanoate

CAS REGISTRY NO: 108-05-4

FORMULA: C4-H6-O2

MOLECULAR WEIGHT: 86.09

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 72.5

MELTING POINT, CELSIUS: -93

FLASH POINT, CELSIUS: -6.00

SOLUBILITY, IN WATER: 25 g/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: A carcinogen. Moderate toxicity.

SAMPLING METHOD: SW-846 No. 0030 (VOST)

ANALYSIS METHOD:

SW-846 No. 5040 (Purge and trap-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

When heated to decomposition, this compound emits acrid fumes. It polymerizes to solid on exposure to light. It is flammable and reacts with oxidizing materials.

SOLUTIONS:

RECORD NUMBER: 180

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Vinyl bromide

CAS REGISTRY NO: 593-60-2

FORMULA: C2-H3-Br

MOLECULAR WEIGHT: 106.96

COMPOUND CLASS:

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 16

MELTING POINT, CELSIUS: -139

FLASH POINT, CELSIUS:

SOLUBILITY, IN WATER: Insol.

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: High toxicity via oral route.

SAMPLING METHOD: Method 106

ANALYSIS METHOD:

GC/MS

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Reactive

DESCRIPTION OF PROBLEMS:

Heat decomposition of this compound emits highly toxic Br fumes. It can react violently with oxidizing materials and is flammable.

SOLUTIONS:

RECORD NUMBER: 669

DATE OF LATEST ENTRY: 09/12/91

COMPOUND: Vinyl chloride
Chloroethene

CAS REGISTRY NO: 75-01-4

FORMULA: C2-H3-(Cl)

MOLECULAR WEIGHT: 62.50

COMPOUND CLASS: Chlorinated hydrocarbon

APPENDIX 8? Y APPENDIX 9? Y CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS: 2

UDRI THERMAL STABILITY RANKING: 60

BOILING POINT, CELSIUS: -13.37 (at 760 mm)

MELTING POINT, CELSIUS: -153

FLASH POINT, CELSIUS: 78.00

SOLUBILITY, IN WATER: Slightly sol

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Flammable; listed as a carcinogen by the EPA

SAMPLING METHOD: SW-846 No. 0030 (VOST), sampling bag or M 106

ANALYSIS METHOD:

SW-846 No. 5040, Draft Method 5041, GC/MS after bag samp or M 106

VALIDATION STATUS:

The VOST method has been validated for this compound (see "Validation Studies of the Protocol for the VOST", JAPAC Vol. 37, NO. 4, 388-394, 1987). However, recoveries were poor for low levels and for wet conditions. Also see "Recovery of POHCs and PICs From a VOST", EPA-600/7-86-025 and "Development of the VOST for use in Determining Incinerator Efficiency", Hazardous and Industrial Solid Waste Testing: Fourth Symposium, ASTM STP 386 pp335-343 (1986).

GENERAL PROBLEM TYPE(S): Sampling

SPECIFIC PROBLEM TYPE(S): Breakthrough

DESCRIPTION OF PROBLEMS:

Slightly soluble in water. Very volatile. May need bag or modified VOST conditions. Boiling point is well below limit of 30 C for optimum VOST performance. Thus, breakthrough is possible if care is not taken.

SOLUTIONS:

Samples need to be analyzed as soon after sampling as possible to prevent losses. As an alternative method, bag sampling may be used.

RECORD NUMBER: 181

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: Xylene
Xylenes (mixed o-, m- and p- isomers)

CAS REGISTRY NO: 133-02-07

FORMULA: C₆H₄(CH₃)₂

MOLECULAR WEIGHT: 106.17

COMPOUND CLASS: Flammable liquid

APPENDIX 8? N

APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 140

MELTING POINT, CELSIUS: -47.9

FLASH POINT, CELSIUS: 29.0

SOLUBILITY, IN WATER: Insol.

HEAT OF COMBUSTION, KCAL/MOLE: 1090.0

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity. May be narcotic in high concentrations.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Incompatible with strong oxidizers.

SOLUTIONS:

RECORD NUMBER: 182

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: m-Xylene
1,3-Dimethylbenzene

CAS REGISTRY NO: 108-38-3

FORMULA: C8-H10

MOLECULAR WEIGHT: 106.17

COMPOUND CLASS: Flammable Liquid

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 138.5

MELTING POINT, CELSIUS:

FLASH POINT, CELSIUS: 25.00

SOLUBILITY, IN WATER:

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

This compound is flammable and incompatible with strong oxidizers.

SOLUTIONS:

RECORD NUMBER: 183

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: o-Xylene
1,2-Dimethylbenzene

CAS REGISTRY NO: 95-47-6

FORMULA: C8-H10

MOLECULAR WEIGHT: 106.17

COMPOUND CLASS: Flammable Liquid

APPENDIX 8? N APPENDIX 9? N

CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 144

MELTING POINT, CELSIUS: -4

FLASH POINT, CELSIUS: 32.00

SOLUBILITY, IN WATER: 175 mg/L

HEAT OF COMBUSTION, KCAL/MOLE: 1091.7

COMBUSTION RANKING:

TOXICITY DATA: Moderate Toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

This compound is flammable and incompatible with strong oxidizers.

SOLUTIONS:

RECORD NUMBER: 184

DATE OF LATEST ENTRY: 09/28/90

COMPOUND: p-Xylene
1,4-Dimethylbenzene

CAS REGISTRY NO: 106-42-3

FORMULA: C8-H10

MOLECULAR WEIGHT: 106.17

COMPOUND CLASS: Flammable Liquid

APPENDIX 8? N APPENDIX 9? N CLEAN AIR ACT OF 1990? Y

UDRI THERMAL STABILITY CLASS:

UDRI THERMAL STABILITY RANKING:

BOILING POINT, CELSIUS: 138

MELTING POINT, CELSIUS: 12.5

FLASH POINT, CELSIUS: 27.0

SOLUBILITY, IN WATER: 198 mg/L

HEAT OF COMBUSTION, KCAL/MOLE:

COMBUSTION RANKING:

TOXICITY DATA: Moderate toxicity.

SAMPLING METHOD: SW-846 No. 0010 (MM5)

ANALYSIS METHOD:

SW-846 No. 8270 (Extraction-GC/MS)

VALIDATION STATUS:

GENERAL PROBLEM TYPE(S):

SPECIFIC PROBLEM TYPE(S):

DESCRIPTION OF PROBLEMS:

Flammable. Incompatible with strong oxidizers.

SOLUTIONS: